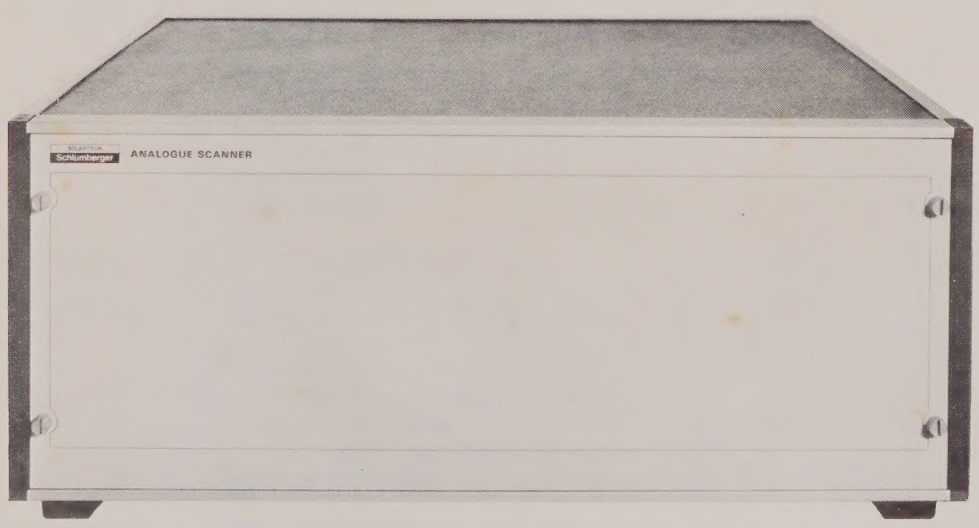
Schlumberger

TECHNICAL DATA

SERIES 3
ANALOGUE
SCANNER

105/A2712
2718
2719

SERIES 3 ANALOGUE SCANNER



Part No: 33010071

Date of Issue : July 1974

Schlumberger

THE SOLARTRON ELECTRONIC GROUP LIMITED
FARNBOROUGH HAMPSHIRE ENGLAND GU14 7PW
TEL: FARNBOROUGH 44433 (STD 0252)
CABLES: SOLARTRON FARNBOROUGH HANTS.
TELEX: 85245 SOLARTRON FARNBOROUGH

TECHNICAL MANUAL

19©74

Printed in England by The Solartron Electronic Group Ltd.

CONTENTS

		Page
SECTION 1	**INTRODUCTION**	1.1
SECTION 2	**GENERAL DESCRIPTION**	2.1
	Introduction	2.1
	Scanner Assembly	2.2
	Basic Scanner Operation	2.4
	Channel Program Addressing	2.7
	Channel Skipping	2.7
	Cold Junction Compensation	2.7
	Strain Gauge Bridge Options	2.8
	Scanner Servicing	2.9
SECTION 3	**TECHNICAL SPECIFICATION**	3.1
SECTION 4	**INSTALLATION**	4.1
	Introduction	4.2
	Module Linking	4.3
	Input Selector Linking Charts	4.4
	Location of Modules	4.7
	Application Mixing	4.7
	System Cabling	4.7
	Cable Schedules	4.13
SECTION 5/1	**CONTROL INTERFACE 3304**	5/1.1
	Introduction	5/1.1
	Linking Instructions	5/1.2
	Analogue Isolation	5/1.2
	Scanner Address	5/1.2
	Selector Module Address	5/1.3
	Signal Conditioning	5/1.4
	Call Program from Channel Address	5/1.5
	Servicing Information	5/1.9
SECTION 5/2	**SELECTOR MODULES 3303/3305**	5/2.1
	Servicing Information	5/2.3
SECTION 5/3	**SELECTORS 3307/3308/3309**	5/3.1
	Skip Selector Panel 3307	5/3.1
	Program Selector Panel 3308	5/3.1
	Program Selector Panel 3309	5/3.2
	Servicing Information	5/3.3
SECTION 5/4	**STRAIN GAUGE MODULES**	5/4.1
	Strain Measurement	5/4.1
	Gauge Factor G	5/4.1
	Strain Gauge Modules 3311/3312/3313/3314/3315/3316	5/4.1
	Input Module 3311	5/4.3
	Bridge Completion Modules	5/4.3
	Module 3312	5/4.3
	Module 3313	5/4.3
	Module 3314	5/4.3
	Control Panels	5/4.3
	Control Panel 3315	5/4.3
	Control Panel 3316	5/4.3

SECTION 5/4 cont.	Selection of Option and Configuration	5/4.4
	Methods of Obtaining the Various Options and Configurations	5/4.5
	Example 1	5/4.6
	Example 2	5/4.7
	Example 3	5/4.7
	Example 4	5/4.8
	Example 5	5/4.8
	Example 6	5/4.9
	Example 7	5/4.9
	Example 8	5/4.11
	Control Interface and Selector Module Linking	5/4.11
	Balance Adjustment	5/4.11
	Scale Adjustment	5/4.11
	Simulating a Calibration Strain	5/4.11
	Setting the Power Supply	5/4.12
	Setting Remaining Channels	5/4.12
	Measuring Strain	5/4.12
	Servicing Information	5/4.13
SECTION 5/5	**POWER SUPPLY UNITS 3317/3318**	5/5.1
	Introduction	5/5.1
	Input Power	5/5.1
	Output Connections	5/5.2
	Output Controls	5/5.2
	Servicing Information	5/5.3
SECTION 5/6	**THERMOCOUPLE COLD JUNCTION COMPENSATION UNIT 3310**	5/6.1
	Introduction	5/6.1
	General Description	5/6.2
	Range of Reference Units	5/6.3
	Fitting a Reference Unit	5/6.3
	Programming	5/6.4
	Servicing Information	5/6.5
SECTION 5/7	**PLATINUM RESISTANCE THERMOMETER POWER SUPPLY 3377**	5/7.1
	Introduction	5/7.1
	Output Connections	5/7.1
	Output Controls	5/7.1
	Servicing Information	5/7.3

SECTION 1 Introduction

The Series 3 Analogue Scanner is basically an electronically controlled multiposition switch which is used to connect one of a large number of analogue signals to a common point. In most applications the scanner forms part of a data acquisition system containing a digital voltmeter which measures the analogue signals so that they can be recorded. The scanner can also provide signal conditioning for transducers and can call channel programs in a data logging system. The Series 3 Analogue Scanner is fully compatible with the Solartron Compact - 33 Data Logger, Computer Logger and Data Transfer Unit.

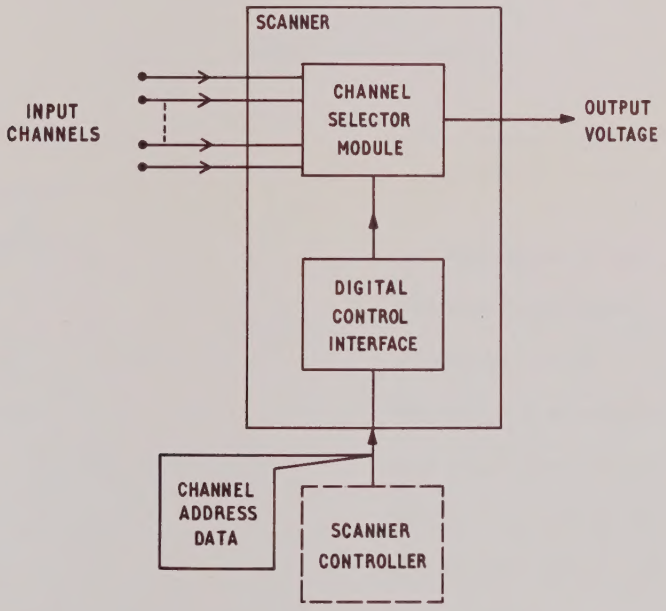


Fig. 1 Scanner: Simplified Block Diagram

A simplified block diagram of the scanner is shown in Fig. 1. The scanner controller is remote from the scanner and normally is part of the logging system. When a channel is to be selected the scanner controller issues the appropriate channel address data to the digital control interface. Decoding of the address data takes place, resulting in the corresponding channel relay being energised. The channel relays are contained in the selector module. When a relay is energised its contacts route the selected input channel to a common output rail.

SECTION 2 General Description

A basic Analogue Scanner comprises a 3301 Mainframe, a 3304 Control Interface and up to ten 3305 or 3303 Input Selectors with 3306 Input Connectors. In addition to these essential modules, a comprehensive selection of options can be used, for such purposes as cold junction compensation, strain gauge bridge completion, and individual channel program addressing. A list of the scanner modules is given in Table 1, and an example of a scanner equipped with most of these modules is shown in Fig. 1 (front view) and Fig. 2 (rear view). For a list of the scanner modules currently available write to Solartron Schlumberger Ltd.

Table 1 *Scanner Modules*

3301 Mainframe

3302 Blank Panel (1.5″ width)

3303 Input Selector 3 pole

3304 Control Interface

3305 Input Selector 4 pole

3306 Input Connector Panel

3307 Skip Selector

3308 Program Selector

3309 Program Selector

3310 Cold Junction Compensator

3311 Input Connector Panel

Strain Gauge Completion Modules:

3312 ½ Bridge Completion Module (No balance, no scale)

3313 ½ Bridge Completion Module (Individual balance, common scale)

3314 ½ Bridge Completion Module (Individual balance, individual scale)

3315 Control Panel (Individual balance, common scale)

3316 Control Panel (Individual balance, individual scale)

3317 Single Power Supply

3318 Twin Power Supply

3320 Scanner Casing

3321 Extension Board for 3304

3325 SALES CODE for 3301 plus 3304 plus 3320

3326 SALES CODE for 3305 plus 3306

3327 SALES CODE for 3303 plus 3306

3373 Strain Gauge Calibration Switch

3374 Dual Current Power Supply

3377 Platinum Resistance Thermometer Power Supply

SCANNER ASSEMBLY

All the scanner modules, with the exception of the self-contained constant current power supplies 3317, 3318, 3374 and 3377, are housed in the 3301 Mainframe. As illustrated in Fig. 2, the 3304 Control Interface, the 3305/3303 Input Selectors and the 3312/3313/3314 Bridge Completion Modules are inserted at the rear of the mainframe, and are secured by means of an appropriate input connector panel (3306 or 3311) or, in the case of the 3304, Interface a cable retaining plate. The 3304 Control Interface must always occupy the position shown in Fig. 2; the other modules, however, can occupy any position in the scanner mainframe. A typical arrangement is shown in Figs. 1 and 2. The 3310 Cold Junction Compensator fixes to the rear of the mainframe by means of an end mounted retaining plate and two knurled screws, and completely covers all the input connector panels.

A printed circuit motherboard within the mainframe provides all the interconnections between the 3304 Control Interface and a) the 3305/3303 Input Selectors, b) the 3312/3313/3314 Bridge Completion Modules. The motherboard is approximately half module height and allows access to the input selectors and bridge completion modules by the front mounted modules shown in Fig. 1. Access to the front mounted modules is obtained by removing the scanner front panel.

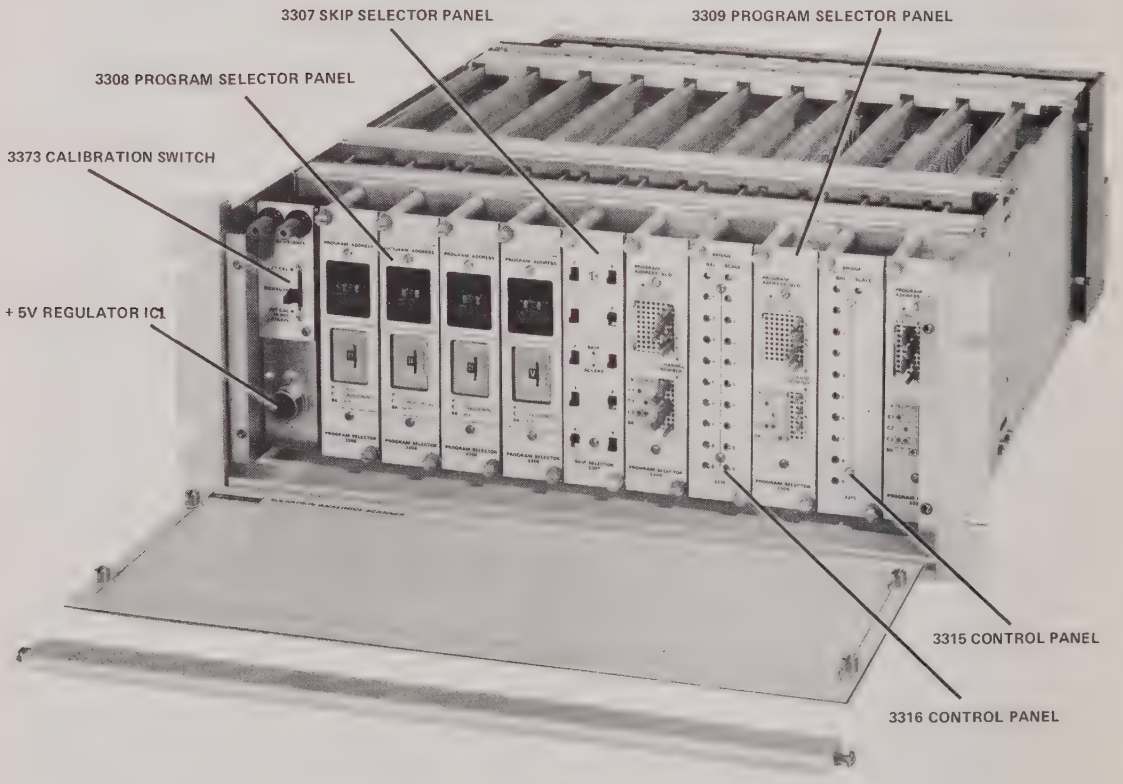


Fig. 1 Scanner : Front View

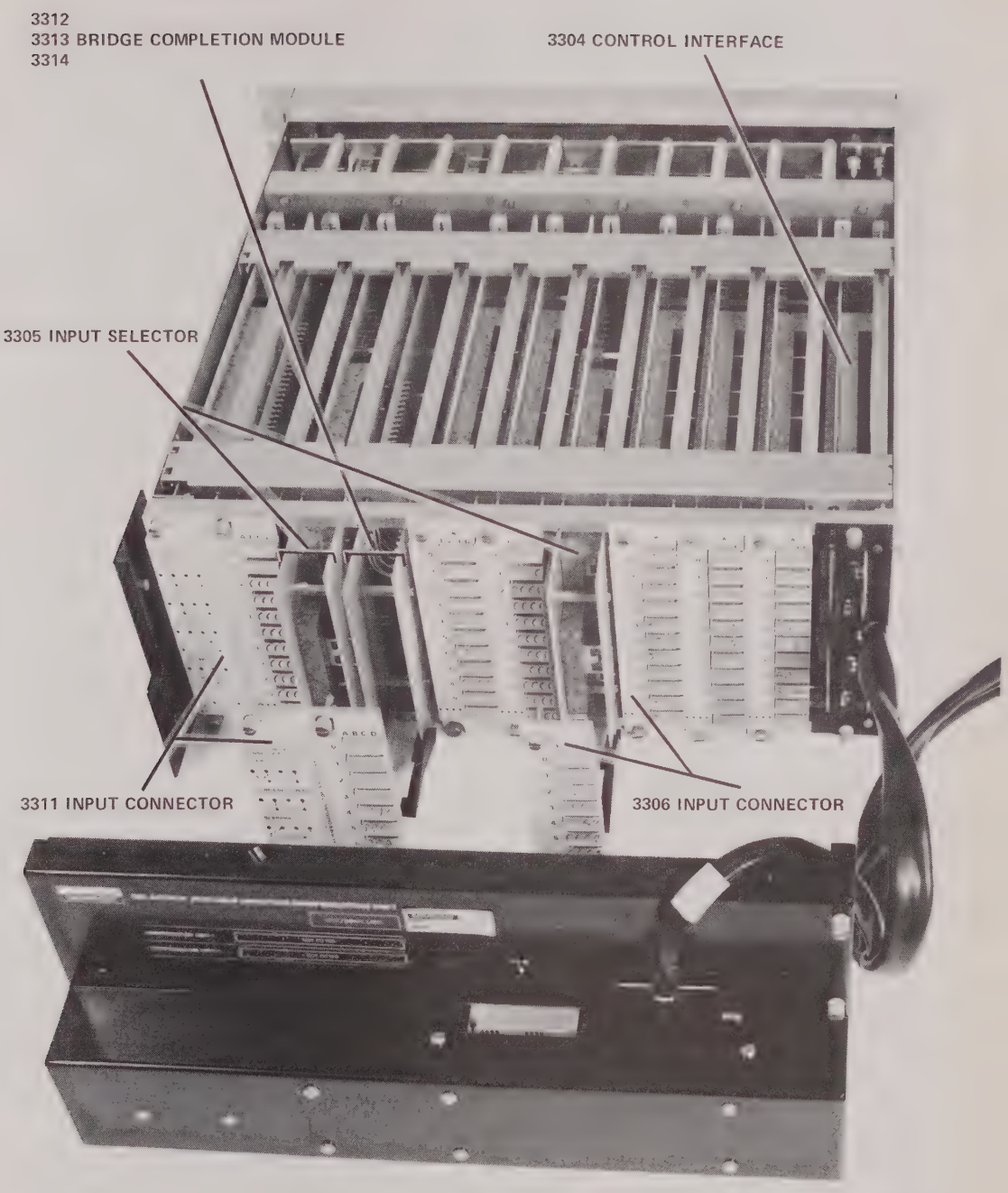


Fig. 2 Scanner : Rear View

BASIC SCANNER OPERATION

The basic scanner circuitry can be divided into two areas - digital and analogue. The digital circuitry performs channel selection, while the analogue circuitry conveys the analogue signal from each transducer input thus selected to a common output.

DIGITAL CIRCUITRY (Fig. 3)

Channel selection is carried out in response to the three BCD decades of channel address which the 3304 Control Interface receives from the scanner controller - 3215 in the case of a DTU and 3353 in the case of Compact 33 and the Computer Logger. Each channel address decade relates to a particular level in the scanner hierarchy: the 'hundreds' decade defines a scanner; the 'tens' decade defines an input selector within that scanner; and the 'units' decade defines a channel within the input selector.

Referring to Fig. 3, the 'hundreds' and the 'tens' decades of channel address are decoded by the 3304 Control Interface. The 'hundreds' decade, via the corresponding 'hundreds address of this scanner' link, allows the control interface to function, while the 'tens' decade, via the 'selector module address' links, calls up a particular input selector. The 'units' decade of channel address is passed by the control interface, unchanged in form, to the input selector called by the 'tens' decade. Here it is decoded to energise the appropriate channel relay.

To ensure that a scanner consumes minimum power, the 3304 Control Interface and the 3305/ 3303 Input Selectors each include a power rail switch that is switched on only while the module is responding to a channel address.

ANALOGUE CIRCUITRY (Fig. 4)

When a selector module channel relay is energised the input signal applied to that channel is passed via the relay contacts to analogue bus A or analogue bus B. The choice of whether the signal is fed to bus A or bus B is determined by the position of links on the selector module. Once the choice is made it applies to all channels on that selector module.

The reasons for having both bus A and bus B are twofold. When selector modules are made to work in pairs (for up to eight pole switching) one selector module can be linked to bus A and the other to bus B. Each bus has four lines thus, with this arrangement, eight switched lines are provided. The other reason for having two buses is to enable two types of measuring device to be used.

Because of pick-up and stray capacitance inherent in multi-scanner operation, the outputs from bus A and bus B are taken via contacts of isolation relays. Thus, at any time during operation, only the scanner whose channels are being addressed is connected to the common output lines. The contacts of the isolation relays can be shorted out by links if required (this is done during manufacture for bus A). If more than one scanner is used in the system these links, if present, should be removed.

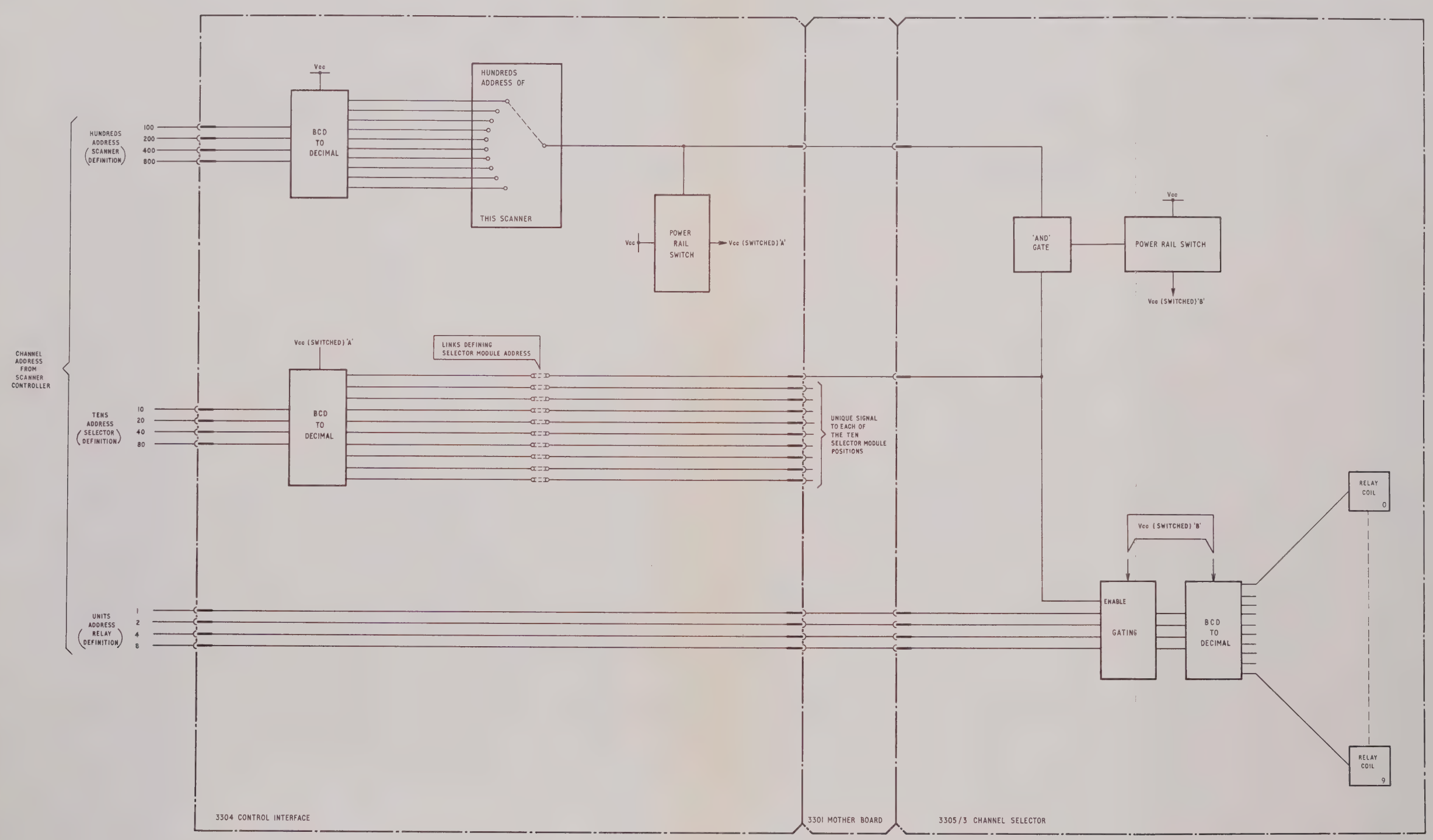


Fig. 3 Scanner Digital Circuitry

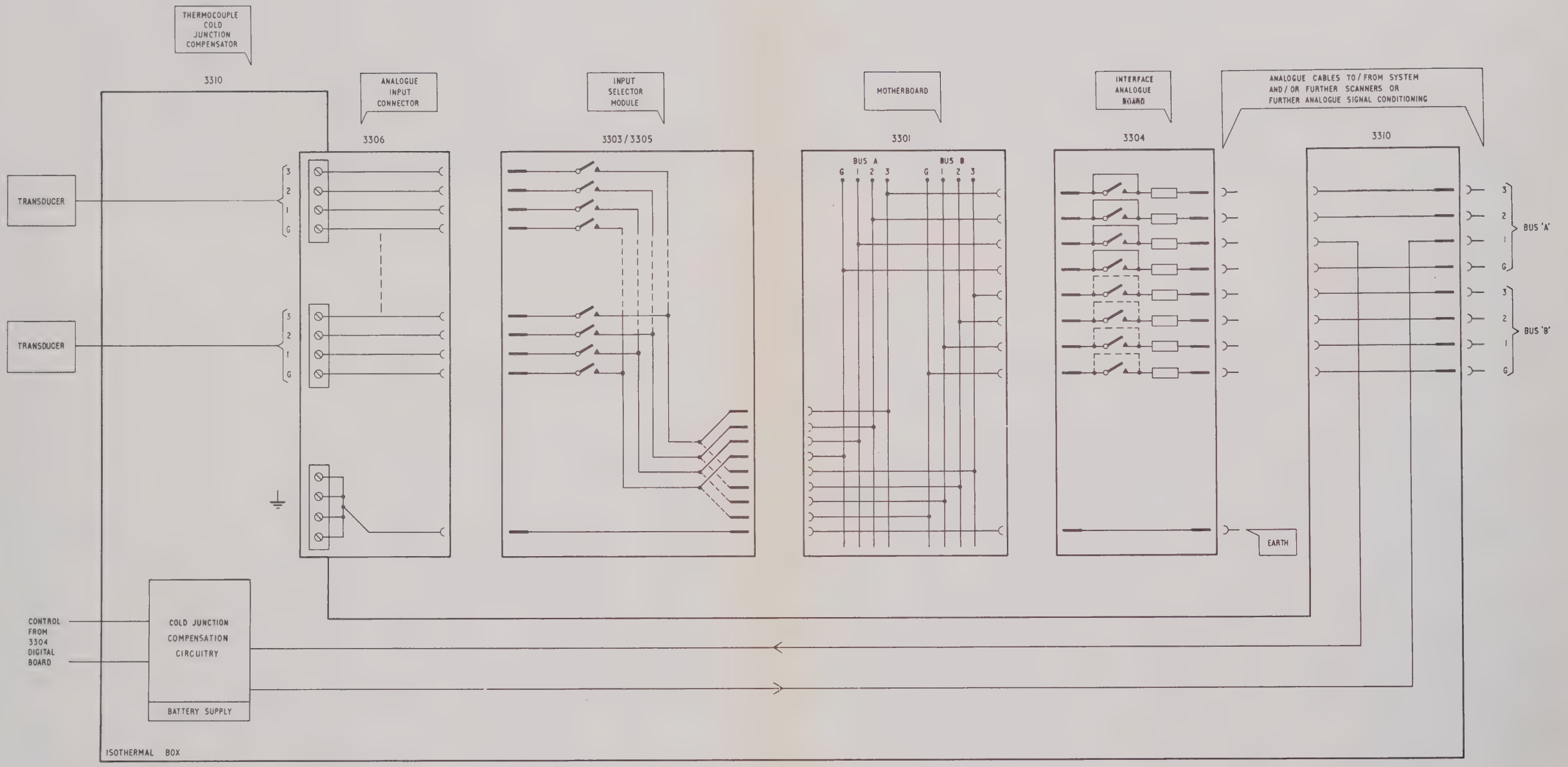


Fig. 4 Scanner Analogue Circuitry

CHANNEL PROGRAM ADDRESSING

Channel program addresses – as used by the Compact - 33 Data Logger – are produced either by the 3304 Control Interface or by a 3308/3309 Program Selector module.

The program addresses produced by the 3304 Control Interface are determined by the *call program from channel address* links – see Section 5/1.

To increase channel programming flexibility, each 3303/3305 Input Selector in the scanner can be used in conjunction with an individual 3308/3309 Program Selector. The 3308 Program Selector provides for the setting up of a program address which, depending on the position of a *channels affected* link at the rear of the module, is common to:-

(a) All channels of the input selector onto which the module is plugged or,

(b) All channels in the scanner.

The 3309 Program Selector enables an individual program address to be set up for each channel of the input selector onto which it is plugged. For details of the 3308 or 3309 Program Selector refer to Section 5/3.

Both methods of producing program addresses can be used in the same scanner. In this case the program addresses from a program selector override any that may be produced by the 3304 Control Interface for the same channel.

CHANNEL SKIPPING

Any unwanted channel in a scanning sequence can be skipped individually by means of a 3307 Skip Selector, or the skip facility on a 3309 Program Selector. A skip facility is also available on the 3308 Program Selector, although this is only applicable to blocks of ten channels or all channels in the scanner - see Section 5/3.

COLD JUNCTION COMPENSATION

Cold junction compensation for thermocouples is provided for by the 3310 Cold Junction Compensator. This unit is in the form of an isothermal box, containing a compensation network, which encloses all the input connectors at the rear of the scanner. The compensation network, when commanded to do so, superimposes a voltage on a thermocouple output that corresponds to the difference in temperature of the cold junctions (input connector terminals) from $0^{o}C$.

The compensating network can employ two reference units (sense modules), thus enabling the cold junction compensator to be used with two different types of thermocouple. Reference unit selection is carried out by the *compensation commands* that are produced by:-

(a) The 3304 Control Interface – in which case they are programmed by the *signal conditioning for selector module* links – or,

(b) A program selector module. No *signal conditioning for selector module* links should be fitted for channels where compensation commands are called by a program selector.

Details of the 3310 Cold Junction Compensator are given in Section 5/6, while the *signal conditioning for selector module* links are covered in Section 5/1.

STRAIN GAUGE BRIDGE OPTIONS

In Wheatstone bridge strain gauge applications an Input Selector is paired with one of three types of Bridge Completion Module, each type providing for a particular balance and scale option, as follows:-

3312 - No balance and no scale (option 'A')

3313 - Individual bridge balance and common scale (option 'B')

3314 - Individual bridge balance and individual channel scale (option 'C')

All three types contain ten half-bridge completion circuits which, in conjunction with the dummy resistor circuitry in the 3311 Input Connector, enable each channel of the accompanying Input Selector to be set up for full, half or quarter bridge strain gauges, individually. Details of the linking for this, and for balance range, are given in Section 5/4.

To accomodate an input selector and its companion bridge completion module, the associated *selector module address* links in the 3304 Control Interface are connected to call the two modules simultaneously - see Section 5/1, page 5/1.3.

SCANNER SERVICING

To assist in locating the area of a possible fault, a block diagram of the scanner is given in Fig. 5 which,

(a) Summarises the function of each module in the scanner mainframe and

(b) Provides an alphabetic reference to all the input, output and intermodule signals of the scanner.

The alphabetic signal references relate to Table 2, which lists against each reference: the signal functions, the logic level significances, and the identity of the connector/pin on which each signal appears.

Having identified the faulty module or modules, refer to the circuit details at the rear of the appropriate module information section, as indicated on the scanner block diagram. The circuit details given for each module provide for the location of each faulty component and for the subsequent replacement of it with an equivalent item, and comprise:

(a) circuit diagram

(b) circuit description

(c) calibration or test procedure, where appropriate

(d) component location diagram(s)

(e) component parts list(s)

CAUTION Front mounted scanner modules (e.g. 3308, 3316) should not be inserted without the corresponding module (e.g. 3305, 3313) in place to ensure correct alignment.

ANALOGUE BUSSES TO DVM

(X)

INPUTS FROM THERMOCOUPLES ETC.

3310 Cold Junction Compensator

Circuit Details : Section 5/6

The 3310 Cold Junction Compensator is in the form of an isothermal box, containing a voltage compensating network, which fits over the input connectors at the rear of the Scanner. The compensation network produces a voltage that corresponds to the difference in temperature of the thermocouple cold junctions (input connector terminals) from $0^{o}C$. This voltage is superimposed on the transducer output by insertion into line 1 of Analogue Bus 'A'.

(U) ANALOGUE BUSSES

(V) COMPENSATION COMMAND

(W) SWITCHED POWER RAIL

†

3306 Input Connector Panel

Thermocouples, platinum resistance thermometers and similar transducers are connected to an Input Selector through a 3306 Input Connector. This module facilitates the connection or disconnection of a complete block of transducer inputs.

†The way in which transducers the input terminals of the 330 Panel depends on the type of and on the method of applica Installation.

(N)

3304 Control Interface

The 3304 Control Interface is programmed by means of wire links to respond to a particular group of channel addresses (A). For each of these addresses it calls up the appropriate channel in the appropriate Input Selector and routes the resulting analogue signal ('D' in, 'U' out) to the system DVM. Additionally, for each channel, the Control Interface produces a program address (Y) for the 3353 Scanner Controller and a cold junction compensation command (V) for the 3310 Cold Junction Compensator. Details of the wire link programming for the 3304 Control Interface are contained in Section 5/1.

(A) CHANNEL ADDRESS FROM SCANNER CONTROLLER

CHANNEL ADDRESSING

The 3304 Control Interface functions only while the 'hundreds' decade of channel address corresponds to the setting of the 'hundreds address of this scanner' links. During this time the 'tens' decade of channel address is decoded to call the appropriate Input Selector(s), via the 'tens drive' lines (C). The way in which the 'tens drive' lines are called depends on the setting of the 'selector module address' links. When an Input Selector is called it is able to respond to the 'units' decade of channel address (C), which the 3304 Control Interface applies in BCD form to all Input Selectors in the Scanner. This address defines the required channel.

CHANNEL 'SKIPPING'

If the Input Selector addressed is absent from the Scanner, then the associated 'tens drive' output of the Control Interface remains in the 'not called' state and a 'skip channel' signal (Y) is issued to the Scanner Controller, for each of the associated ten channels. Also, in the case of a multiple scanner system, the analogue busses between inlets 'D' and outlets 'U' of the Control Interface are open-circuited by means of isolation relays. When an Input Selector is used in conjunction with a Skip Selector or a Program Selector it can be programmed to make the Control Interface issue a 'skip channel' signal for individual channels. In this case, however, no analogue bus isolation takes place.

(B) POWER SUPPLIES FROM MAIN SYSTEM

CHANNEL PROGRAM ADDRESSING

Program addresses (Y) originate either in the 3304 Control Interface - in which case they are determined by the 'call program from channel address' links - or in a Program Selector. When a Program Selector is in use, the effect of the 'call program from channel address' links is inhibited by an 'override' signal (E) from this module.

COLD JUNCTION COMPENSATION

Cold junction compensation commands (V), where required, are programmed either by the 'signal conditioning for selector module' links on the 3304 Control Interface or by a Program Selector. No 'signal conditioning for selector module' links are fitted when a Program Selector is used.

Vcc SWITCHING

When the 3304 Control Interface is not responding to its particular group of channel addresses, the Vcc supply to the majority of circuit elements within the Scanner is switched off. A transistor switch in the Control Interface controls the Vcc supply to this module and the 3310 Cold Junction Compensator, while each Input Selector has an individual Vcc switch.

(Y) PROGRAM ADDRESS AND 'SKIP / ACCEPT CHANNEL' TO SCANNER CONTROLLER

Circuit Details : Section 5/1

Program/Skip Selector

3307 Skip Selector Panel. This module, by means of ten channel-related slide switches, enables each channel of an Input Selector to be programmed individually for 'skip' or 'accept'. When a 'skip' channel is addressed the Skip Selector Panel produces a 'unit skip' signal.

3308 Program Selector Panel. This module provides for the setting up of a program address and cold junction compensation command (or 'skip') which, depending on the position of a 'channels affected' link at the rear of the module, is common to a) all channels of the Input Selector onto which the module is plugged or b) all channels in the Scanner.

3309 Program Selector Panel. This module enables an individual program address and cold junction compensation command (or 'skip') to be set up for each channel of the Input Selector onto which it is plugged. Setting up is by means of diode pinboards, the diode pattern in each channel-related row corresponding to the BCD signal produced, in response to the appropriate channel identity, at the module output. (Diode inserted = logical '1').

(L) CHANNEL IDENTITY

(M) PROGRAM ADDRESS ETC.

Circuit Details : Section 5/3

3305/3303 Input Selector

The Scanner can contain a maximum of ten 3303 or 3305 Input Selectors. Each selector responds uniquely to a particular 'tens drive' (selector definition) signal (G), during which time it multiplexes a group of ten analogue input channels (N) under control of the 'units address' (channel definition) signals (G).

The correspondence of an Input Selector with a particular 'tens drive' signal is determined by a) the position that the module occupies in the Scanner and b) the setting of the 'selector module address' links in the 3304 Control Interface. Where the 'selector module address' links are connected one to one, as in the standard arrangement (see Section 5/1) the Input Selectors are called in succession from right to left, looking from the Scanner rear.

To increase channel programming flexibility, each Input Selector can be used with an individual Program Selector. Each decimal channel identity 'L' issued by the Input Selector produces, from the Program Selector, a corresponding program address, compensation command, etc. (M), which are routed, through the Input Selector, to the 3304 Control Interface.

When an Input Selector is not responding to a channel address, a transistor switch contained within the module switches off the Vcc supply to its channel selection logic.

Circuit Details : Section 5/2

(G) (H) (J) (K)

(C) SELECTOR AND CHANNEL DEFINITION

(D) ANALOGUE BUSSES

(E) CHANNEL PROGRAM, SKIP AND COMPENSATION

(F) Vcc AND COMMON RAIL

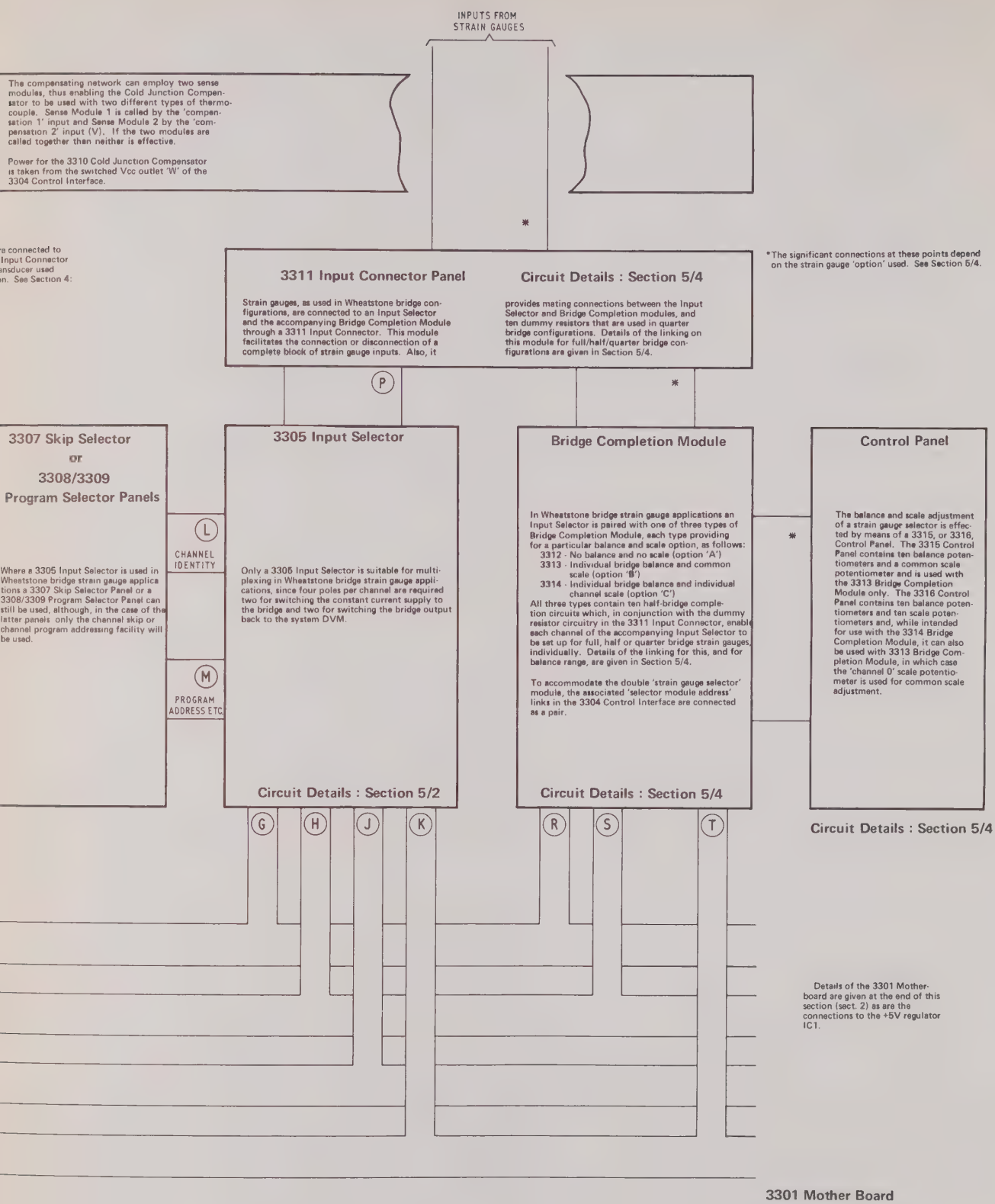

INPUTS FROM STRAIN GAUGES
The compensating network can employ two sense modules, thus enabling the Cold Junction Compensator to be used with two different types of thermocouple. Sense Module 1 is called by the 'compensation 1' input and Sense Module 2 by the 'compensation 2' input (V). If the two modules are called together then neither is effective.
Power for the 3310 Cold Junction Compensator is taken from the switched Vcc outlet 'W' of the 3304 Control Interface.
*
*The significant connections at these points depend on the strain gauge 'option' used. See Section 5/4.
3311 Input Connector Panel
Circuit Details : Section 5/4
Strain gauges, as used in Wheatstone bridge configurations, are connected to an Input Selector and the accompanying Bridge Completion Module through a 3311 Input Connector. This module facilitates the connection or disconnection of a complete block of strain gauge inputs. Also, it
provides mating connections between the Input Selector and Bridge Completion modules, and ten dummy resistors that are used in quarter bridge configurations. Details of the linking on this module for full/half/quarter bridge configurations are given in Section 5/4.
P
*
3307 Skip Selector
or
3308/3309
Program Selector Panels
Where a 3305 Input Selector is used in Wheatstone bridge strain gauge applications a 3307 Skip Selector Panel or a 3308/3309 Program Selector Panel can still be used, although, in the case of the latter panels only the channel skip or channel program addressing facility will be used.
L
CHANNEL IDENTITY
M
PROGRAM ADDRESS ETC.
3305 Input Selector
Only a 3305 Input Selector is suitable for multiplexing in Wheatstone bridge strain gauge applications, since four poles per channel are required two for switching the constant current supply to the bridge and two for switching the bridge output back to the system DVM.
Circuit Details : Section 5/2
Bridge Completion Module
In Wheatstone bridge strain gauge applications an Input Selector is paired with one of three types of Bridge Completion Module, each type providing for a particular balance and scale option, as follows:
3312 - No balance and no scale (option 'A')
3313 - Individual bridge balance and common scale (option 'B')
3314 - Individual bridge balance and individual channel scale (option 'C')
All three types contain ten half-bridge completion circuits which, in conjunction with the dummy resistor circuitry in the 3311 Input Connector, enable each channel of the accompanying Input Selector to be set up for full, half or quarter bridge strain gauges, individually. Details of the linking for this, and for balance range, are given in Section 5/4.
To accommodate the double 'strain gauge selector' module, the associated 'selector module address' links in the 3304 Control Interface are connected as a pair.
Circuit Details : Section 5/4
*
Control Panel
The balance and scale adjustment of a strain gauge selector is effected by means of a 3315, or 3316, Control Panel. The 3315 Control Panel contains ten balance potentiometers and a common scale potentiometer and is used with the 3313 Bridge Completion Module only. The 3316 Control Panel contains ten balance potentiometers and ten scale potentiometers and, while intended for use with the 3314 Bridge Completion Module, it can also be used with 3313 Bridge Completion Module, in which case the 'channel 0' scale potentiometer is used for common scale adjustment.
Circuit Details : Section 5/4
G
H
J
K
R
S
T
Details of the 3301 Motherboard are given at the end of this section (sect. 2) as are the connections to the +5V regulator IC1.
3301 Mother Board

Fig. 5 Scanner Block Diagram

Table 2 *Scanner Interconnections*

Signal Location	Connector/Pin Identity	Signal Function	Logic Level Significance
A	PLA, PLB on 3304:	Channel Address:	
	Pin 18A	'100'	
	19A	'200' — Scanner Definition	
	20A	'400'	
	17A	'800'	
	9B	'10'	Lo = '1'
	10B	'20' — Input Selector Definition	
	8B	'40'	Hi = '0'
	16A	'80'	
	20B	'1'	
	19B	'2' — Channel Definition	
	18B	'4'	
	17B	'8'	

Table 2 cont.

Signal Location	Connector/Pin Identity	Signal Function	Logic Level Significance
B	PLA, PLB on 3304:	Scanner Supplies:	
	Pin 1A - 5A	+9V	
	1B	Common Rail 1	
	3B - 7B	Common Rail 2	
	11B - 13B	+5V	
	16B	Earth	
C	PLC on 3304; SKA on 3301:		
	Pin 22	Hundreds Detail	Lo = Scanner Called
	11	'00'	
	13	'10'	
	15	'20'	
	17	'30'	
	19	'40' Tens Drive: Input Selector Definition	Hi = Selector Called
	21	'50'	
	23	'60'	
	25	'70'	
	27	'80'	
	29	'90'	
	18	'1'	
	16	'2' Units Address: Channel Definition	Lo = '1' Hi = '0'
	14	'4'	
	12	'8'	

Table 2 cont.

Signal Location	Connector/Pin Identity	Signal Function	Logic Level Significance
D	PLC on 3304; SKA on 3301:		Standard Bus Allocation:
	Pin 5	3 — Analogue Bus 'A'	I_1+
	6	2 — Analogue Bus 'A'	DVM Lo
	7	1 — Analogue Bus 'A'	DVM Hi
	8	G — Analogue Bus 'A'	DVM Guard
	1	3 — Analogue Bus 'B'	I_1-
	2	2 — Analogue Bus 'B'	I_2-
	3	1 — Analogue Bus 'B'	I_2+
	4	G — Analogue Bus 'B'	I_1 and I_2 Guard
	10	Earth	
E	PLC on 3304; SKA on 3301:		
	Pin 30	'1' — Program Address	Lo = '1' Hi = '0'
	31	'2' — Program Address	Lo = '1' Hi = '0'
	32	'4' — Program Address	Lo = '1' Hi = '0'
	33	'8' — Program Address	Lo = '1' Hi = '0'
	34	'10' — Program Address	Lo = '1' Hi = '0'
	35	'20' — Program Address	Lo = '1' Hi = '0'
	36	'40' — Program Address	Lo = '1' Hi = '0'
	37	'80' — Program Address	Lo = '1' Hi = '0'
	20	Override	Lo = Override
	28	Unit Skip	Lo = Skip Channel
	38	'1' — Compensation Command	Lo = '1' Hi = '0'
	39	'2' — Compensation Command	Lo = '1' Hi = '0'

Table 2 cont.

Signal Location	Connector/Pin Identity	Signal Function	Logic Level Significance
F	PLC on 3304; SKA on 3301:	Input Selector Supplies:	
	Pin 24	+5V	
	26	Common Rail	
G	PLA on 3305, Board 1; SKC, E, G, etc. on 3301:		
	Pin 9	Hundreds Detail	Lo = Scanner Called Hi = Selector Called
	1	Tens Drive	
	5	'1'	
	4	'2' Units Address	Lo = '1' Hi = '0'
	3	'4'	
	2	'8'	
H	PLB on 3305, Board 2; SKD, F, H, etc. on 3301:		Standard Bus Allocation:
	Pin 5	3	I_1+
	6	2 Analogue Bus	DVM Lo
	7	1 'A'	DVM Hi
	8	G	DVM Guard
	1	3	I_1
	2	2 Analogue Bus	I_2–
	3	1 'B'	I_2+
	4	G	I_1 and I_2 Guard
	10	Earth	

Table 2 cont.

Signal Location	Connector/Pin Identity	Signal Function		Logic Level Significance
J	PLA on 3305, Board 1; SKC, E, G, etc. on 3301:			
	Pin 13	'1'		
	14	'2'		
	15	'4'		
	16	'8'	Program	Lo = '1'
	17	'10'	Address	Hi = '0'
	18	'20'		
	19	'40'		
	20	'80'		
	6	Override		Lo = Override
	12	Unit Skip		Lo = Skip Channel
	7	'1'	Compensation	Lo = '1'
	8	'2'	Command	Hi = '0'
K	PLA on 3305, Board 1; SKC, E, G, etc. on 3301:			
	Pin 10	+5V		
	11	Common Rail		

Table 2 cont.

Signal Location	Connector/Pin Identity	Signal Function		Logic Level Significance
L	PLB on 3305, Board 1; SKA on 3307, 3308, 3309:			
	Pin 3A	'0'	Channel Identity	Lo = Channel Called
	4A	'1'		
	5A	'2'		
	6A	'3'		
	8A	'4'		
	9A	'5'		
	10A	'6'		
	11A	'7'		
	12A	'8'		
	13A	'9'		
	11B	Hundreds Detail		Lo = Scanner Called
	2A	Tens Detail		Lo = Selector Called
M	PLB on 3305, Board 1; SKA on 3307, 3308, 3309:			
	Pin 9B	'1'	Program Address	Lo = '1' Hi = '0'
	8B	'2'		
	6B	'4'		
	5B	'8'		
	4B	'10'		
	3B	'20'		
	2B	'40'		
	1B	'80'		

Table 2 cont.

Signal Location	Connector/Pin Identity	Signal Function	Logic Level Significance
M cont.	1A	Override	
	10B	Unit Skip	
	13B	'1' | Compensation Command	Lo = '1' Hi = '0'
	12B	'2' | Compensation Command	Lo = '1' Hi = '0'
N	PLA on 3305/3, Board 2; SKA on 3306:	3305: 3303:	
	Pin 1	G G	CH'0'
	2	1 1	CH'0'
	3	2 2	CH'0'
	4	3	CH'0'
	6	G G	CH'1'
	7	1 1	CH'1'
	8	2 2	CH'1'
	9	3	CH'1'
	11	G G	CH'2'
	12	1 1	CH'2'
	13	2 2	CH'2'
	14	3	CH'2'
	16	G G	CH'3'
	17	1 1	CH'3'
	18	2 2	CH'3'
	19	3	CH'3'
	21	G G	CH'4'
	22	1 1	CH'4'
	23	2 2	CH'4'
	24	3	CH'4'

Table 2 cont.

Signal Location	Connector/Pin Identity	Signal Function			Logic Level Significance
N cont.	PLA on 3305/3, Board 2; SKA on 3306:	3305:	3303:		
	Pin 26	G	G	CH'5'	
	27	1	1		
	28	2	2		
	29	3			
	31	G	G	CH'6'	
	32	1	1		
	33	2	2		
	34	3			
	37	G	G	CH'7'	
	38	1	1		
	39	2	2		
	40	3			
	43	G	G	CH'8'	
	44	1	1		
	45	2	2		
	46	3			
	47	G	G	CH'9'	
	48	1	1		
	49	2	2		
	50	3			
	53	Earth			

Table 2 cont.

Signal Location	Connector/Pin Identity	Signal Function		Logic Level Significance
P	PLA on 3305, Board 2; SKN on 3311:			
	Pin 1	Vo+	CH'0'	
	2	Vo–		
	3	I+		
	4	I–		
	6	Vo+	CH'1'	
	7	Vo–		
	8	I+		
	9	I–		
	11	Vo+	CH'2'	
	12	Vo–		
	13	I+		
	14	I–		
	16	Vo+	CH'3'	
	17	Vo–		
	18	I+		
	19	I–		
	21	Vo+	CH'4'	
	22	Vo–		
	23	I+		
	24	I–		
	26	Vo+	CH'5'	
	27	Vo–		
	28	I+		
	29	I–		

Table 2 cont.

Signal Location	Connector/Pin Identity	Signal Function	Logic Level Significance
P cont.	PLA on 3305, Board 2; SKN on 3311:		
	Pin 31	Vo+	
	32	Vo–	
	33	I+	CH'6'
	34	I–	
	37	Vo+	
	38	Vo–	
	39	I+	CH'7'
	40	I–	
	43	Vo+	
	44	Vo–	
	45	I+	CH'8'
	46	I–	
	48	Vo+	
	49	Vo–	
	50	I+	CH'9'
	51	I–	
	53	Earth	
R	PLD on 3313, Board 1; SKE, G, J, etc. on 3301:		
	Pin 9	Hundreds Detail	Lo = Scanner Called
	1	Tens Drive	Hi = Selector Called

Table 2 cont.

Signal Location	Connector/Pin Identity	Signal Function		Logic Level Significance
S	PLB on 3312/3/4, Board 2; SKF, H, K etc. on 3301:	3313:		
	Pin 2	I–		
	3	I+		
		3312/3/4:		
	6	Vo–		
T	PLD on 3313, Board 1; SKE, G, J, etc. on 3301:			
	Pin 10	+5V		
	11	Common Rail		
U	PLE on 3304, Board 2; SKA on 3310:			Standard Bus Allocations:
	Pin 11	3	Analogue Bus 'A'	I_1+
	12	2		DVM Lo
	13	1		DVM Hi
	14	G		DVM Guard
	5	3	Analogue Bus 'B'	I_1–
	4	2		I_2–
	3	1		I_2+
	2	G		I_1 and I_2 Guard
V	PLE on 3304, Board 2; SKA on 3310:			
	Pin 17	'1'	Compensation Command	Lo = '1'
	18	'2'		Hi = '0'

Table 2 cont.

Signal Location	Connector/Pin Identity	Signal Function		Logic Level Significance
W	PLE on 3304, Board 2; SKA on 3310:			
	Pin 20	+5V (Switched)		
	19	Common Rail		
X	PLE, PLD on 3310:			Standard Bus Allocations:
	Pin 11	3	Analogue Bus 'A'	I_1+
	12	2		DVM Lo
	13	1		DVM Hi
	14	G		DVM Guard
	5	3	Analogue Bus 'B'	I_1−
	4	2		I_2−
	3	1		I_2+
	2	G		I_1 and I_2 Guard
Y	PLA, PLB on 3304, Board 1:			
	Pin 15A	'1'	Program Address	Lo = '0' Hi = '1'
	14A	'2'		
	13A	'4'		
	12A	'8'		
	11A	'10'		
	10A	'20'		
	9A	'40'		
	8A	'80'		
	2B	Skip/Accept Channel		Lo = Skip Hi = Accept

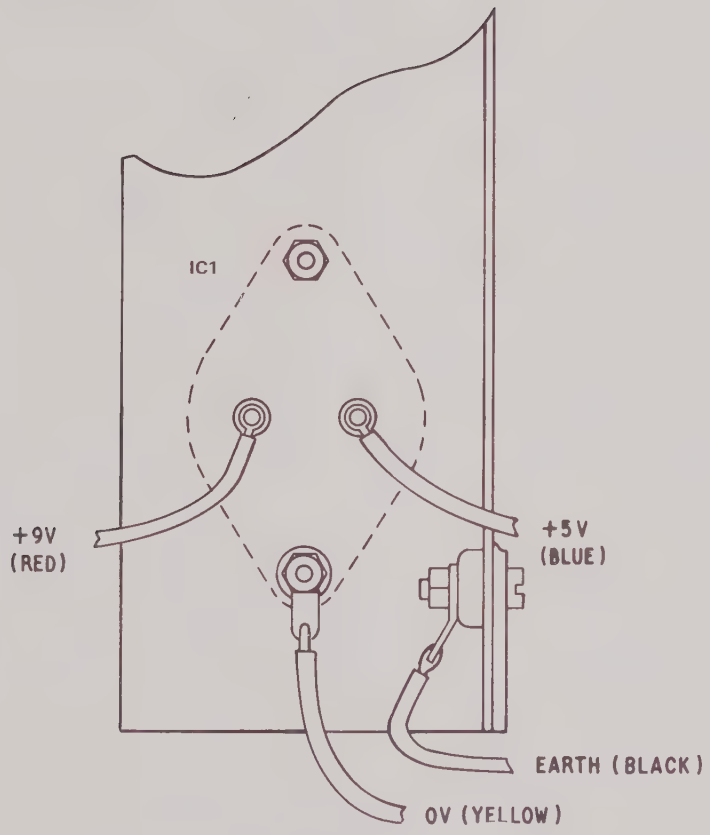
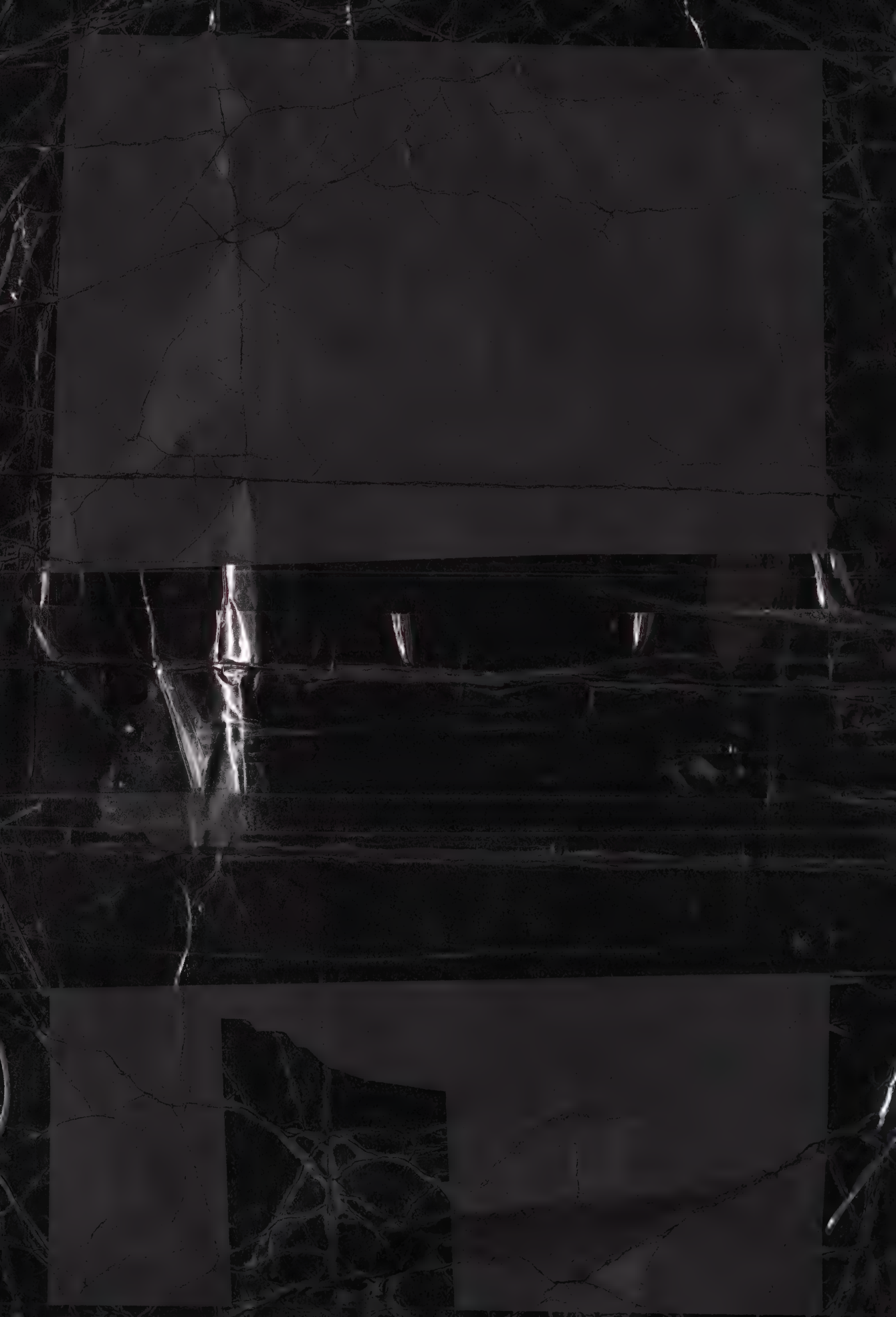
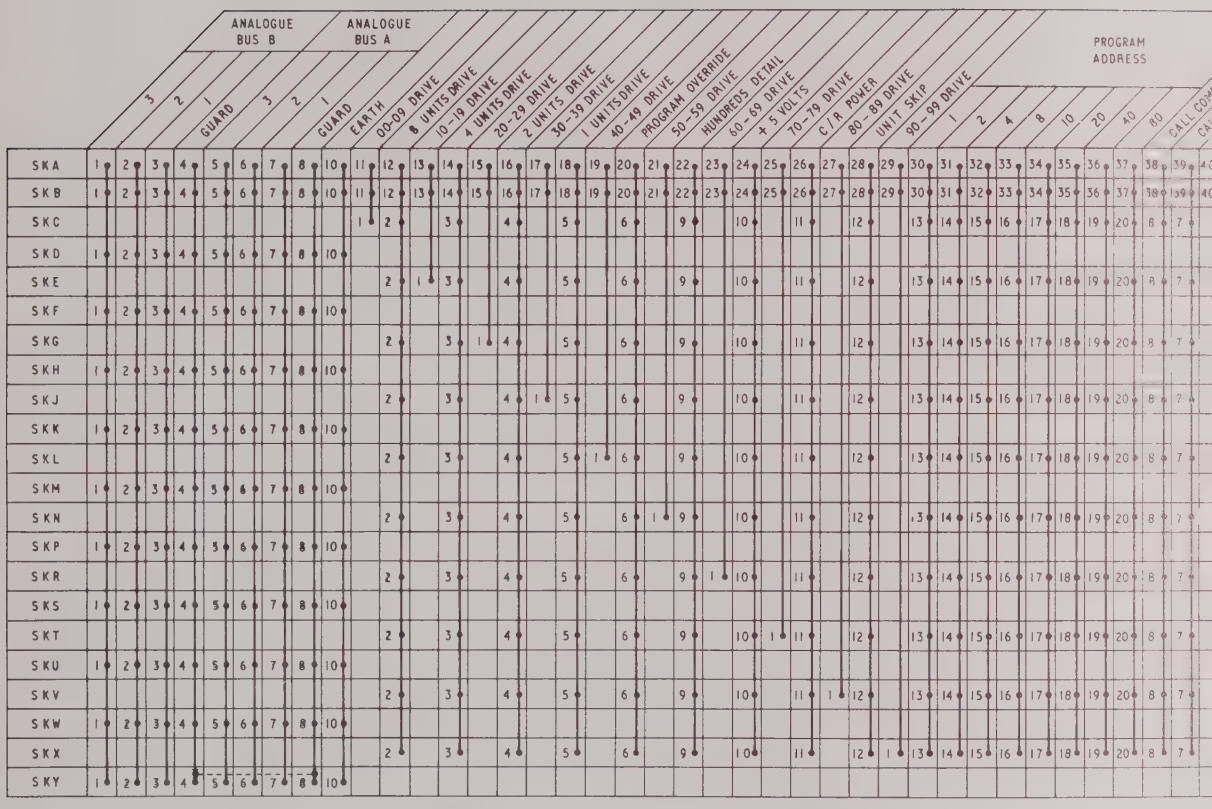
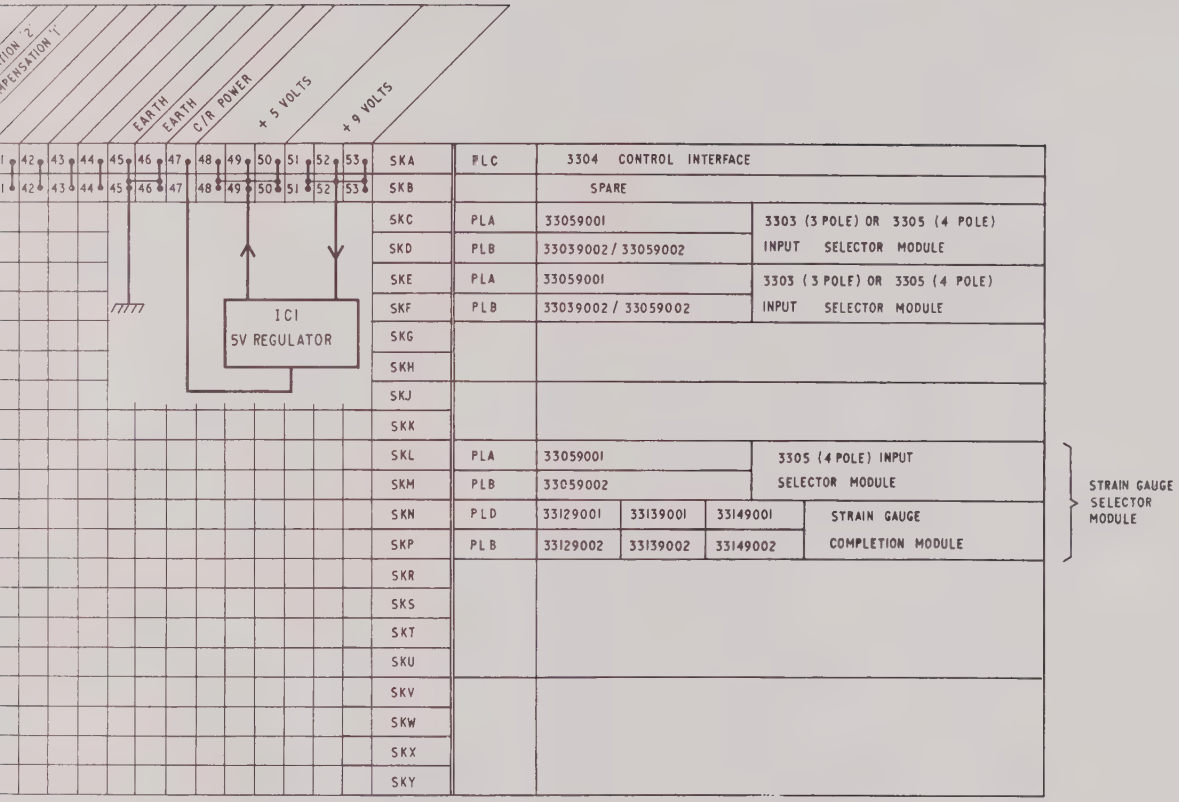


Fig. 6 +5V Regulator Connections.




ANALOGUE BUS B
ANALOGUE BUS A
PROGRAM ADDRESS
3
2
1
GUARD
3
2
1
GUARD
EARTH
00-09 DRIVE
8 UNITS DRIVE
10-19 DRIVE
4 UNITS DRIVE
20-29 DRIVE
2 UNITS DRIVE
30-39 DRIVE
1 UNITS DRIVE
40-49 DRIVE
PROGRAM OVERRIDE
50-59 DRIVE
HUNDREDS DETAIL
60-69 DRIVE
+5 VOLTS
70-79 DRIVE
C/R POWER
80-89 DRIVE
UNIT SKIP
90-99 DRIVE
1
2
4
8
10
20
40
80
CALL COM
CA
SKA
SKB
SKC
SKD
SKE
SKF
SKG
SKH
SKJ
SKK
SKL
SKM
SKN
SKP
SKR
SKS
SKT
SKU
SKV
SKW
SKX
SKY



The 3304 Control Interface is always inserted into SKA. The 3305 (3303) Input Selector modules are always inserted with PLA of PCB 33059001 in one of the following sockets: C, E, G, J, L, N, R, T, V, X.

Where a strain gauge completion module is in use it occupies the two sockets immediately following those occupied by the associated 3305 Input Selector module, as shown.

Fig. 7 Module Interconnections ; 3301 Mainframe

SECTION 3 Technical Specification

Capacity	10 – 100 channels (in 10 channel groups)
Signal Switching	3 – 8 poles (including guard) per channel
Channel to channel isolation	$> 1000M\Omega < 100pF$
Channel to frame isolation	$> 1000M\Omega < 100pF$
Isolation between any two analogue lines	$> 1000M\Omega$
Reed switching	Operate – all 3 or 4 reeds settle to a bounce-free state in $< 6ms$.
	Release – all 3 or 4 reeds release within 2ms.
Maximum voltage between any pair of inputs or between any input and chassis	200V dc
Maximum steady current through any reed	1.5A
Maximum switched current	150mA
Maximum signal error after thermal stability has been reached	$1\mu V$
or, if used in a multi-scanner configuration employing the isolation relays	$2\mu V$
Operating temperature range	0 to $50^{o}C$
Storage temperature range	-20 to $+70^{o}C$
Humidity	70% RH @ $40^{o}C$
Power requirements	Voltage +9V dc ± 10%
	Quiescent current 60mA per scanner
	Operating current 475mA (4 pole), 650mA (8 pole)
Dimensions	Height 177mm (7in)
	Width 483mm (19in)
	Depth 445mm (17.5in)
Weight	14kg (30lb) average.

SECTION 4 Installation

INTRODUCTION

An Analogue Scanner forms an integral part of the data logging system with which it is used and consideration should be given to the requirements of the system as a whole when installation is carried out. The recommended procedure for installation is as follows:-

1. Program the scanner(s) in accordance with the system requirements - if this is not already done - by means of the linking areas detailed under the heading 'Module Linking'.

2. Connect scanner(s) to the system with appropriate cables supplied. Where an existing system is being expanded, ensure that the maximum allowable length of cable between the most remote scanner and the scanner controller is not being exceeded - refer to information under 'Cable Length Considerations'.

To assist in future system modifications or servicing, it is recommended that a record be kept of the physical layout of the scanning system and of the program linking.

For installation details regarding 3317/3318 Power Supplies, 3310 Cold Junction Compensator, and the 3377 Power Supply, refer to Sections 5/5, 5/6 and 5/7, respectively.

CAUTION Front mounted scanner modules (e.g. 3308, 3316) should not be inserted without the corresponding module (e.g. 3305, 3313) in place to ensure correct alignment.

LOCATION OF MODULES

A cut-away view of the scanner showing module location is given in Fig. 4. Modules are plugged into the scanner chassis from the front and the rear. Program selector panels are plugged in from the front, after removal of the front panel. Input selector modules and the control interface are plugged in from the rear.

MODULE LINKING

To enable the scanner to be set up in accordance with the particular requirements of a logging system, various linking areas are provided on the scanner modules, as indicated in Table 1. If the system requirements are specified at the time of ordering then the modules are supplied linked accordingly; otherwise module linking must be carried out during installation.

Table 1 *Module Linking*

Link Identity	Function	Location	Reference
'Hundreds Address of this Scanner'	Definition of the *hundreds* decade of Channel address to which the scanner will respond.	3304 Control Interface; pcb 33049002	Section 5/1; pp 5/1.2 and 5/1.7.
'Selector Module Address'	Allocation of input selector modules to *tens* decades of channel address.	3304 Control Interface; pcb 33049002	Section 5/1; pp 5/1.3 and 5/1.7.
'Signal Conditioning for Selector Module'	Definition of the signal conditioning, e.g. cold junction compensation, for each input selector module*.	3304 Control Interface; pcb 33049002	Section 5/1; pp 5/1.4 and 5/1.7.
'Call Program from Channel Address'	Derivation of program addresses from channel addresses*.	3304 Control Interface; pcb 33049002	Section 5/1; pp 5/1.5 to 5/1.7 inclusive.
Isolation relay shorting links.	To short out the analogue isolation relay contacts on single scanner systems.	3304 Control Interface; pcb 33049001	Section 5/1; page 5/1.2.
Analogue Bus links.	To determine the routeing of analogue input signals to Bus A and/or Bus B.	3303/3305 Input Selectors; pcb 33039002/33059002.	Section 4; Input Selector Linking Charts.
'Channels Affected'	To allocate a common channel program to, a) all channels in an input selector, or b) all channels in the scanner.	3308 Program Selector; pcb 33089001.	Section 5/3; pp 5/3.1 and 5/3.2.
Strain gauge option links.	To detemine the configuration(s) of Wheatstone bridge strain gauge circuits.	Strain Gauge Modules 3311 - 3314	Input Selector Linking Charts and Section 5/4; pp 5/4.4 to 5/4.6 inclusive and 5/4.10.

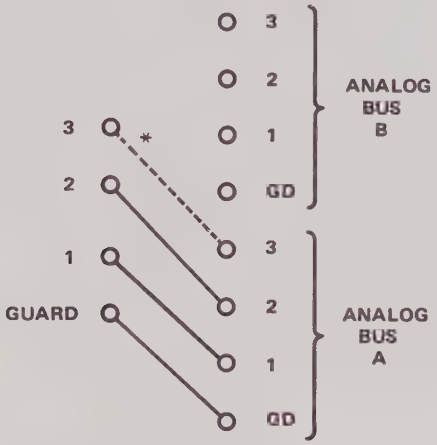
*These functions can also be programmed, with increased flexibility, by the 3308 or 3309 Program Selector panels. Additionally, channel skipping can be programmed - for individual channels using the 3307 Skip Selector or 3309 Program Selector, or for blocks of ten channels (or complete scanner) using the 3308 Program Selector. See Section 5/3.

INPUT SELECTOR LINKING

CHART 1

APPLICATION: Emf measurement only, e.g. thermocouples

ANALOGUE BUS LINKS - pcb 33059002/33039002:



*pcb 33039002 has only three links connected - used on 3303 3-pole Input Selector.

TRANSDUCER CONNECTIONS:

Terminal	Service
1	V+ (signal Hi)
2	V– (signal Lo)
3	
G	Guard

INPUT SELECTOR LINKING

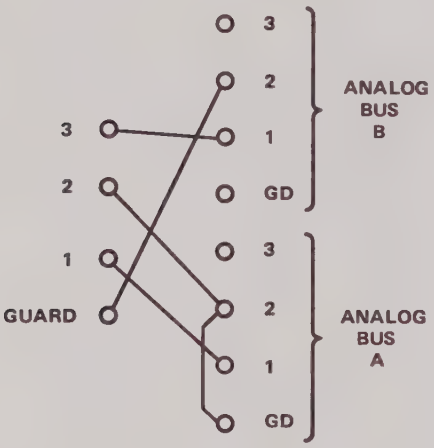
CHART 2

APPLICATION : a) platinum resistance thermometers

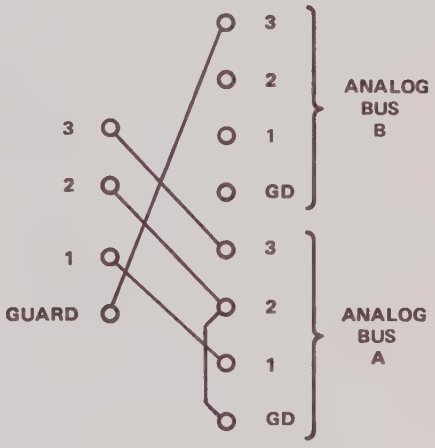
b) linear voltage displacement transducers

c) full (Wheatstone) bridge strain gauges - no balance or scale

ANALOGUE BUS LINKS - pcb 33059002:

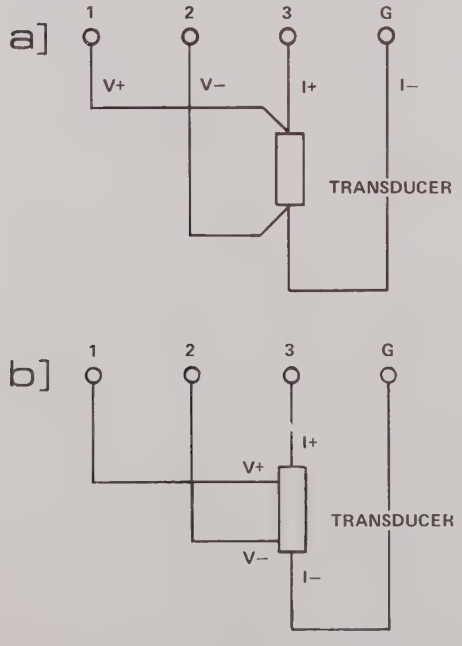


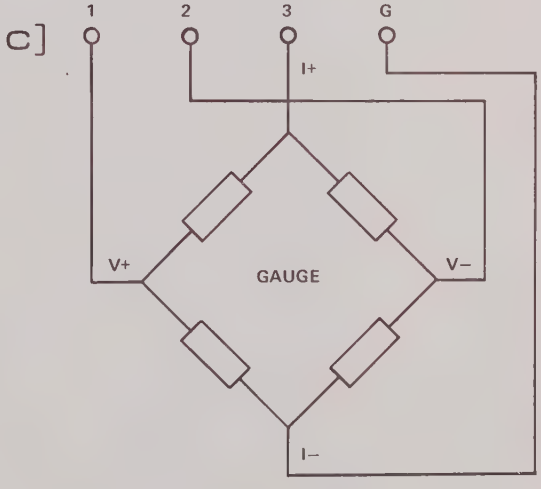
Preferred Linking



Alternative Linking

TRANSDUCER CONNECTIONS:



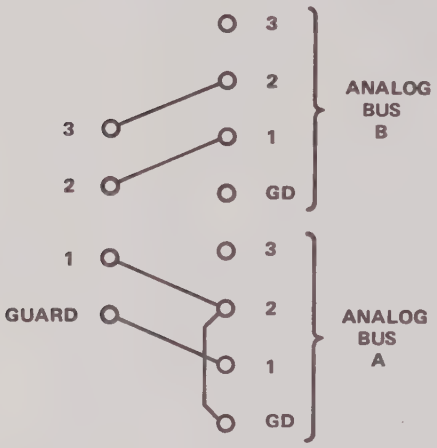


INPUT SELECTOR LINKING

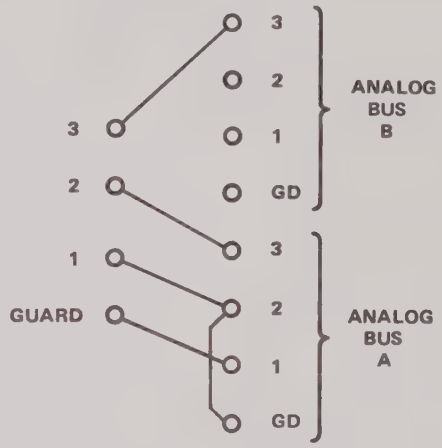
CHART 3

APPLICATION: Full/half/quarter (Wheatstone) bridge strain gauges with balance and scale.

ANALOGUE BUS LINKS - pcb 33059002:

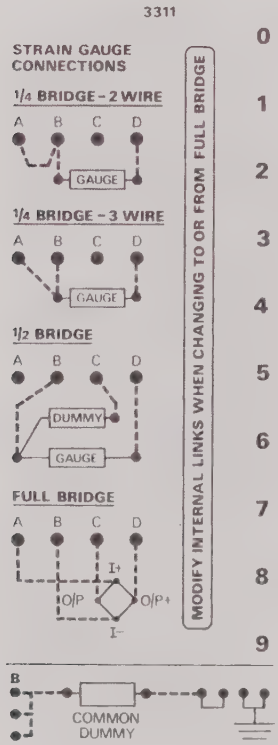


Preferred Linking



Alternative Linking

TRANSDUCER CONNECTIONS:



COMPLETION MODULE LINKING:

Bridge Configuration Links*:-

Configuration	3311	3312/3/4, Board 2
Quarter bridge Half bridge	Link A to C	Link E to D and D to F
Full bridge	Link B to C	No links fitted

*Channel identity indicated by numerical suffix, e.g., D4, E4. F4.

Balance Range Links:-

Contained on board 1 of 3313 and 3314, two links per channel, annotated with channel number:

± 0.3% - no links

± 2.0% - links inserted

NOTE:- For this application the 3305 Input Selector module and its associated Bridge Completion module are addressed as a pair. See Section 5/1 - 'Selector Module Address Links'.

SYSTEM CABLING

Single Scanner

The cable with which a scanner is connected to a logging system plugs directly onto the 3304 Control Interface, being secured there by a cable retaining plate. The location of the various plugs (edge connector type) on the 3304 is shown in Fig. 1. Plugs PLA and PLB are connected in parallel and the associated socket SKA/B on the connector cable can be mated with either one; socket SKA/B carries the digital control signals and the scanner power supply (+9V). Plugs PLD and PLE on the 3304 are also connected in parallel and the associated socket SKD/E on the connector cables carries the analogue signals. Where a 3310 Cold Junction Compensator is in use, plugs PLD and PLE on the 3304 are obscured and the alternative plugs (same identity) on the 3310 must be used.

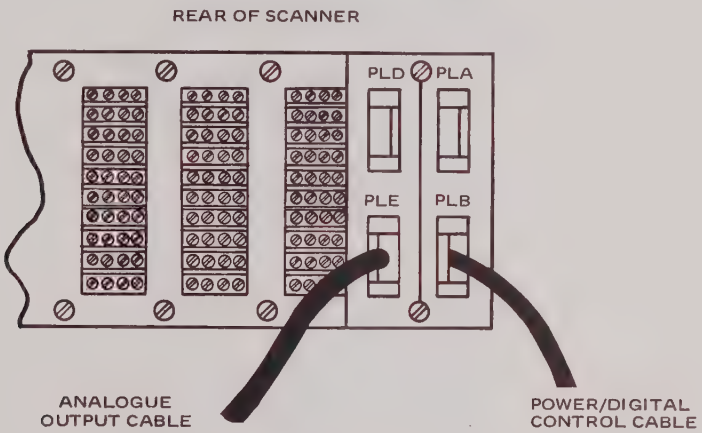


Fig. 1 Single Scanner Connections

The standard scanner cables are listed in Table 2. Cables of extra length can be made to special order and have an L suffix on the type number, e.g. 3390L. Where extremely long lengths of cable are called for, a lower cable resistance can be obtained by connecting the scanners in a 'ring'. In the case of a DTU system a 'forked' cable, type 3382 is supplied for this purpose, and a similar cable for the Compact 33 or the Computer Logger can be made to special order.

Table 2 *Scanner Cables*

No.	Use	
3319	Scanner to DTU and Constant Current Power Supply	
3329	Scanner to C - 33 and Constant Current Power Supply	
3390	Scanner to C - 33	(3′)
3391	Scanner to DTU	(3′)
3392	Scanner to Scanner	(1′- 6″)
3393	Scanner to C - 33	(10′)
3394	Scanner to Scanner	(10′)
3395	Scanner to DTU	(10′)
3282	Scanner to DTU	(forked)

Multiple Scanners

Where several scanners are to be integrated into a system the cables are connected as shown in Fig. 2. With multiple scanner systems the isolation relay shorting links should be removed from all scanners - see Section 5/1, page 5/1.2.

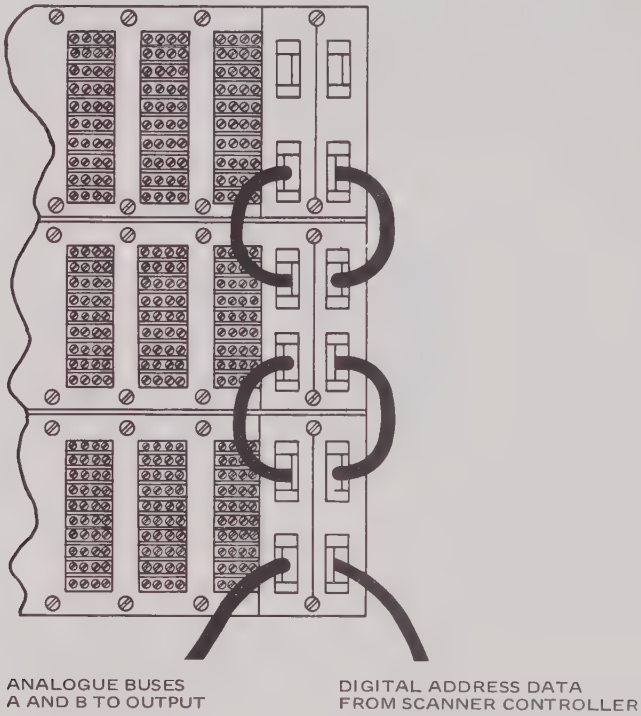


Fig. 2 Multiple Scanner Connections

Cable Length Considerations

Normally a cable of up to 100 metres in length can be used between the scanner controller and the most distant scanner. For cable runs of greater length than this, consideration should be given to the effect of the cable resistance on,

a) the +9V scanner supply, and

b) control signal and analogue signal interference.

The resistance of long cables causes a drop in the supply voltage and for successful operation this should not be less than +7V at any scanner. If necessary, local +9V supplies can be used for distant scanners.

Cable lengths of greater than 100 metres are likely to cause crosstalk in control signal lines or degradation to the analogue signals. These effects can be minimised in most cases, but guidance should be obtained from a Solartron Schlumberger engineer.

Transducer Connections

Transducer connections are made to the input connector panels at the rear of the scanner. Details of the connections for various transducers are given in the Input Selector Linking Charts contained in this section.

The scanner input channels are numbered as shown in Fig. 3. This shows the usual arrangement, but will be varied if any eight pole switching is used. See *selector module address linking,* Section 5/1.

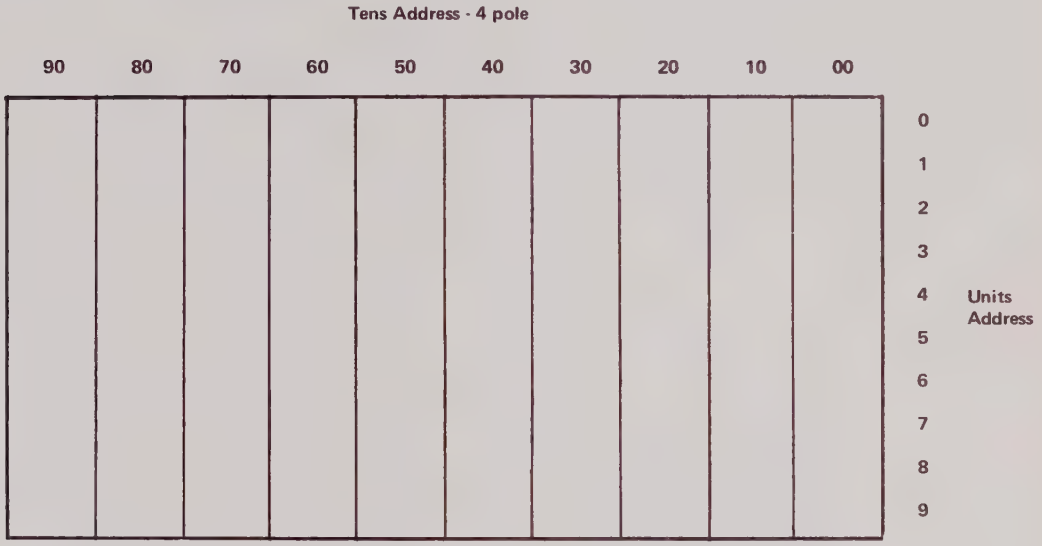


Fig. 3 Channel Numbering

Fig. 4. ⟶

Multiple Scanners

Where several scanners are to be integrated into a system the cables are connected as shown in Fig. 2. With multiple scanner systems the isolation relay shorting links should be removed from all scanners - see Section 5/1, page 5/1.2.

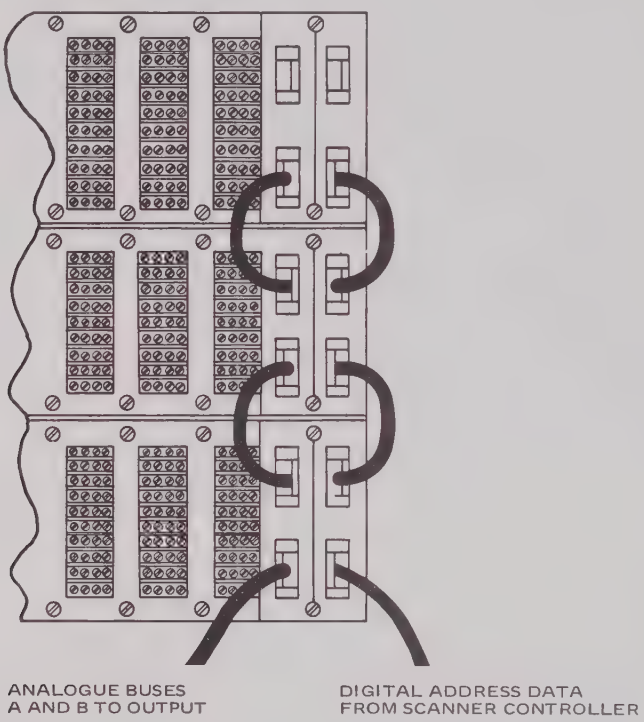


Fig. 2 Multiple Scanner Connections

Cable Length Considerations

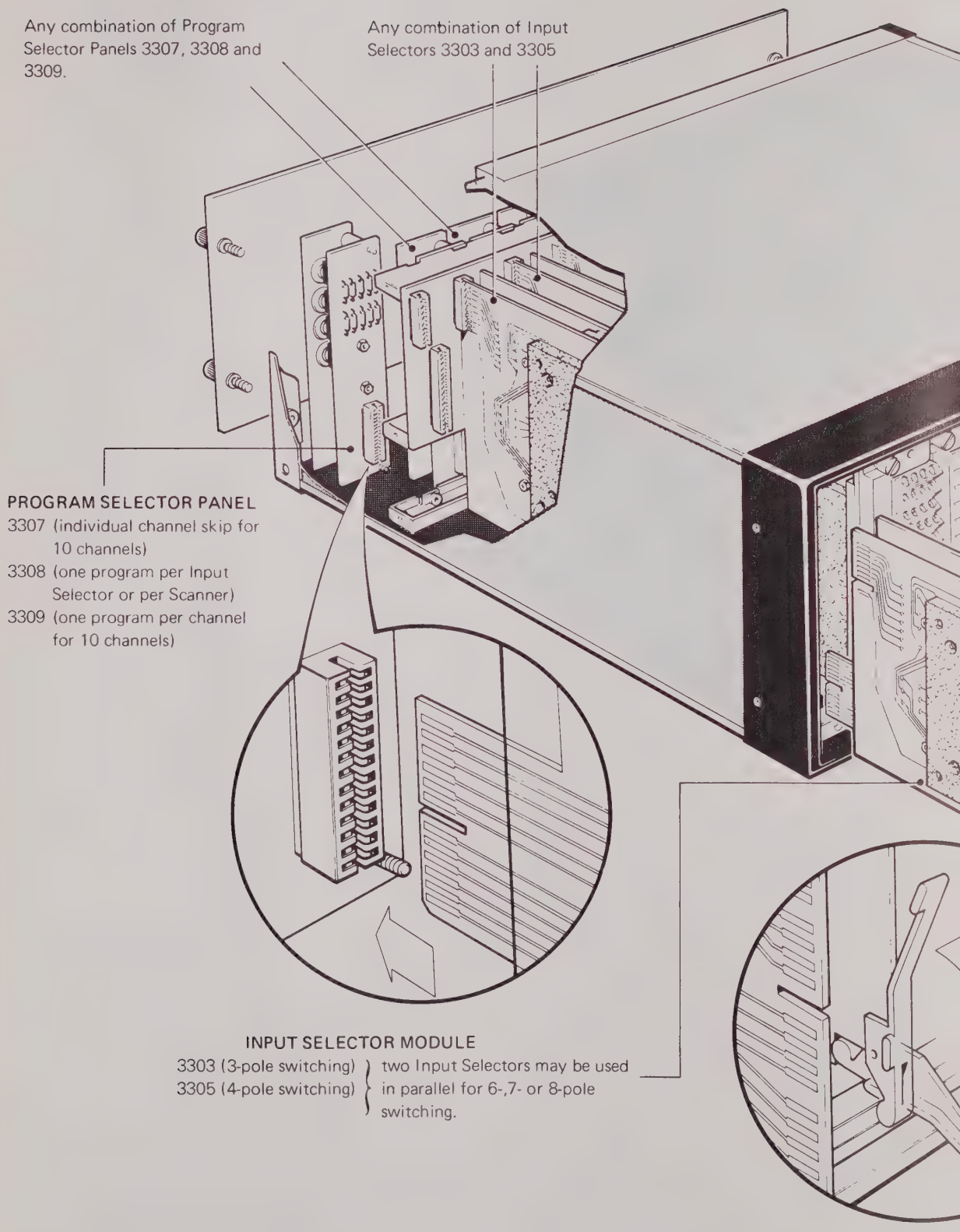
Normally a cable of up to 100 metres in length can be used between the scanner controller and the most distant scanner. For cable runs of greater length than this, consideration should be given to the effect of the cable resistance on,

a) the +9V scanner supply, and

b) control signal and analogue signal interference.

The resistance of long cables causes a drop in the supply voltage and for successful operation this should not be less than +7V at any scanner. If necessary, local +9V supplies can be used for distant scanners.

Cable lengths of greater than 100 metres are likely to cause crosstalk in control signal lines or degradation to the analogue signals. These effects can be minimised in most cases, but guidance should be obtained from a Solartron Schlumberger engineer.


Any combination of Program Selector Panels 3307, 3308 and 3309.
Any combination of Input Selectors 3303 and 3305
PROGRAM SELECTOR PANEL
3307 (individual channel skip for 10 channels)
3308 (one program per Input Selector or per Scanner)
3309 (one program per channel for 10 channels)
INPUT SELECTOR MODULE
3303 (3-pole switching)
3305 (4-pole switching)
two Input Selectors may be used in parallel for 6-,7- or 8-pole switching.

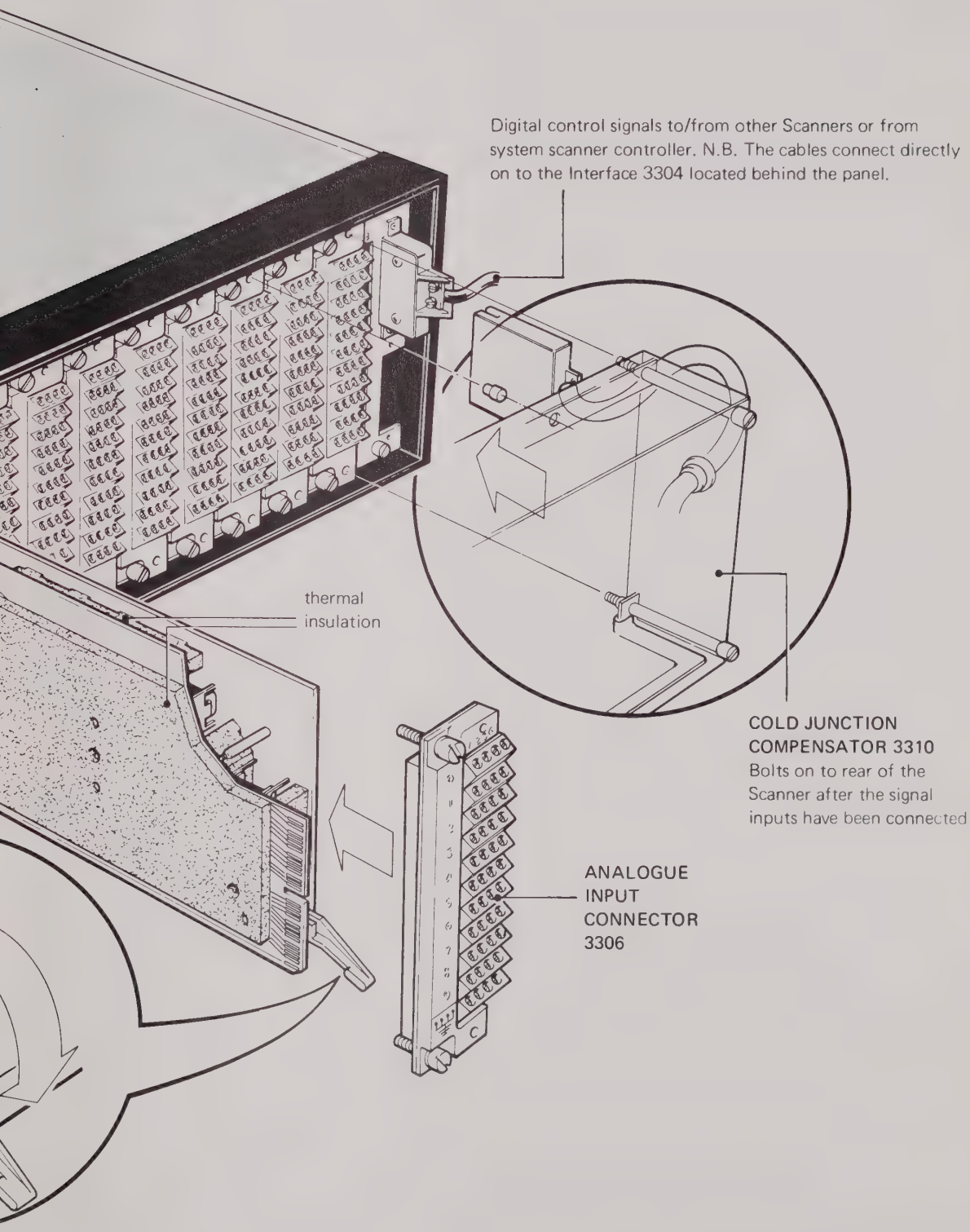

Digital control signals to/from other Scanners or from system scanner controller. N.B. The cables connect directly on to the Interface 3304 located behind the panel.
thermal insulation
COLD JUNCTION COMPENSATOR 3310
Bolts on to rear of the Scanner after the signal inputs have been connected
ANALOGUE INPUT CONNECTOR 3306

Fig. 4 Scanner Assembly

CABLE SCHEDULE : Scanner to C - 33 and Computer Logger

(3329, 3390, 3393)

SKA/B To Scanner (3304)	SERVICE		SKB To 3353 Scanner Controller
18A	100		12A
19A	200		11A
20A	400		14A
17A	800		13A
9B	10		16A
10B	20	Channel	15A
8B	40	Address	18A
16A	80		17A
20B	1		20A
19B	2		19A
18B	4		22A
17B	8		21A
11A	10		5A
10A	20		4A
9A	40		7A
8A	80		6A
		Program Address	
15A	1		9A
14A	2		8A
13A	4		3A
12A	8		2A
2B	Skip/Accept Channel		20B
1B	Common Rail 1		1A
			PLB To 3333 Power Supply
1A, 2A, 3A, 4A, 5A		+9V	1
3B, 4B, 5B, 6B, 7B		CR2	2
16B		Earth	'Amphenol' crimp*

*To earth tag on C-33 chassis - see C-33 Data Logger Operating Manual, page 3.4, Fig. 7.

SKD/E To Scanner (3304)	SERVICE			
	ANALOGUE BUS:		STANDARD ALLOCATION:	
14A	G		DVM Guard	
13A	1	A	DVM Hi	PLA
12A	2		DVM Lo	
11A	3		I_1+	† Spade Term (Red)
2A	G		I_1 and I_2 Guard	† Spade Term (Green)
3A	1	B	I_2+	† Spade Term (Red)
4A	2		I_2-	† Spade Term (Black)
5A	3		I_1-	† Spade Term (Black)

†Spade terminals are fitted, as standard, only to cables 3319 and 3329.

CABLE SCHEDULE : Scanner to DTU

(3319, 3391, 3395, 3282)

Schedule A

SKA/B To Scanner (3304)	SERVICE		PLD To DTU
18A	100		31
19A	200		18
20A	400		32
17A	800		13
9B	10	Channel	29
10B	20	Address	16
8B	40		30
16A	80		17
20B	1		27
19B	2		14
18B	4		28
17B	8		15
2B	Skip/Accept Channel		19
1B	Common Rail 1		35
1A			1
2A			2
3A	+9V		20
4A			21
5A			
3B			3
4B			4
5B	CR2		5
6B			6
7B			7
16B	Earth		8

Cable 3391 and 3395 are as shown in Schedule A; Cable 3282 is a dual version of the same, having two scanner connectors and one DTU connector. Cable 3319 is as shown in Schedule A, but with the additions shown in Schedule B.

Schedule B

SKD/E To Scanner (3304)	SERVICE			
	ANALOGUE BUS:		STANDARD ALLOCATION:	
14A	G		DVM Guard	
13A	1	A	DVM Hi	PLA
12A	2		DVM Lo	
11A	3		I_1+	Spade Term (Red)
2A	G		I_1 and I_2 Guard	Spade Terms (Green)
3A	1	B	I_2+	Spade Term (Red)
4A	2		I_2-	Spade Term (Black)
5A	3		I_1-	Spade Term (Black)

CABLE SCHEDULE : Scanner to Scanner

(3392, 3394)

SKA/B	SERVICE		SKA/B
18A	100		18A
19A	200		19A
20A	400		20A
17A	800		17A
9B	10		9B
10B	20	Channel	10B
8B	40	Address	8B
16A	80		16A
20B	1		20B
19B	2		19B
18B	4		18B
17B	8		17B
11A	10		11A
10A	20		10A
9A	40		9A
8A	80		8A
		Program Address	
15A	1		15A
14A	2		14A
13A	4		13A
12A	8		12A
2B	Skip/Accept Channel		2B
1B	Common Rail 1		1B
1A			1A
2A			2A
3A	+9V		3A
4A			4A
5A			5A
3B			3B
4B			4B
5B	CR2		5B
6B			6B
7B			7B
11B			11B
12B	+5V		12B
13B			13B

SKD/E	SERVICE			SKD/E
	ANALOGUE BUS:		STANDARD ALLOCATION:	
14A	G		DVM Guard	14A
13A	1	A	DVM Hi	13A
12A	2		DVM Lo	12A
11A	3		I_1+	11A
2A	G		I_1 and I_2 Guard	2A
3A	1	B	I_2+	3A
4A	2		I_2-	4A
5A	3		I_1-	5A

SECTION 5/1

Control Interface 3304

INTRODUCTION

This module receives channel address data from the scanner controller and consequently addresses the selector modules contained within the scanner. The 3304 can also call signal conditioning within the scanner, and channel programs in the Compact - 33 data logger. The interface comprises two printed circuit boards, namely, the analogue pcb and the digital pcb. These two boards are assembled together as one unit (Fig. 1).

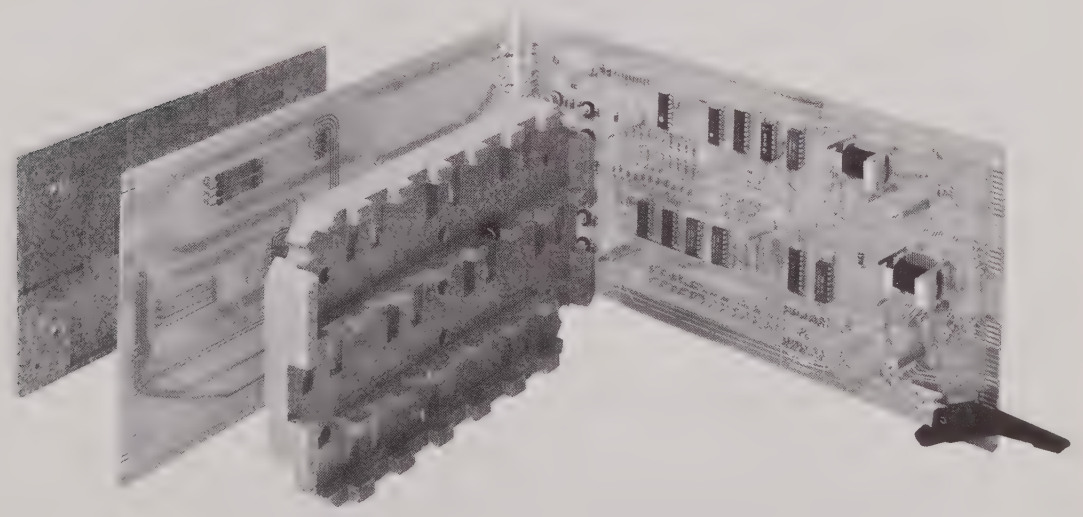


Fig. 1 Dismantled Control Interface

There are comprehensive linking facilities on the interface which, for example, define the hundreds address of the scanner and the allocation of selector modules to the tens decade of channel address. The various linking areas within the interface are shown in Fig. 14.

The interface also contains isolation relays for use when more than one scanner is used in a system. These relays minimise the effects of leakage and capacitance which can cause signal degradation.

LINKING INSTRUCTIONS

Analogue Isolation

During manufacture, the switch contacts of bus A are shorted out by wire links. This is desirable when only one scanner is used in a system, but for multiple scanner operation these links should be removed. A diagram of the links is given in Fig. 2.

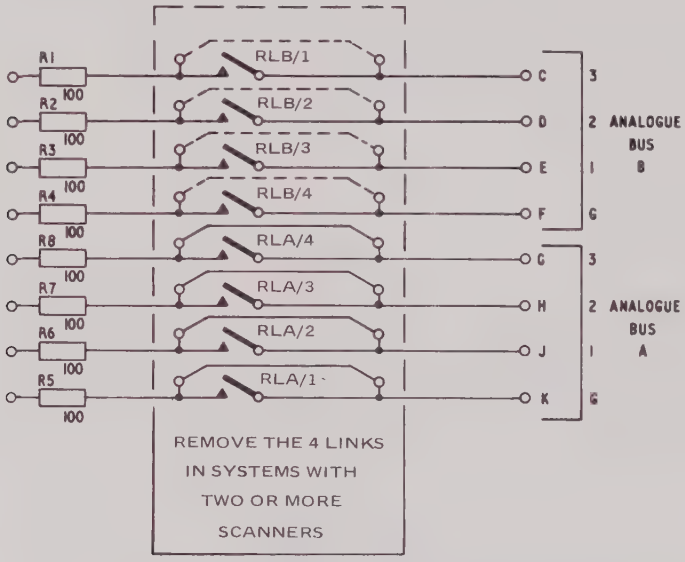


Fig. 2 Analogue Isolation Links

Scanner Address

A given scanner can house channels in any group of hundreds, e.g. 000 to 099, 100 to 199, 700 to 799. The hundreds address of a scanner is defined by the "Hundreds Address of this Scanner" group of pins. All scanners are initially linked to contain the 000 to 099 group of channels (Fig. 3). If it is required to allocate different channel groups to scanners (for multi-scanner operation), then the link must be changed. As an example, Fig. 4 shows the link area connected for addresses in the range 300 to 399.

Note: Only one link should be made in this area.

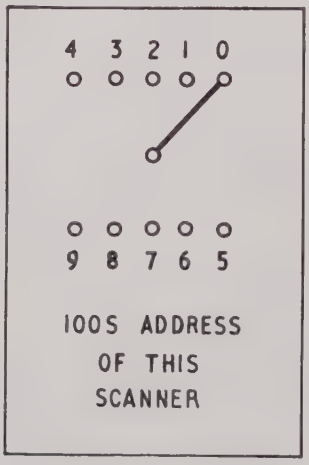


Fig. 3 Standard Linking

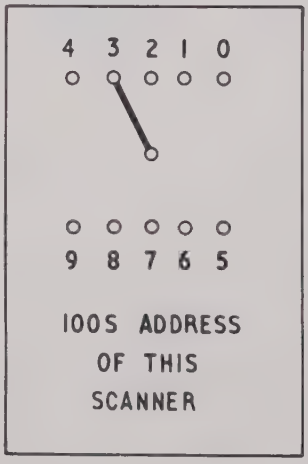


Fig. 4 Linking for addresses 300 - 399

Selector Module Address

Each selector module contains switching for ten channels. The addresses of these channels run from HT0 to HT9, where H is the chosen hundreds address of the respective scanner and T is the tens address of the selector module position. For example if the hundreds address is 3 and the tens address is 5, channels for the selector module in that position would be allocated from 350 to 359.

Tens addresses are allocated to positions in the scanner and therefore to the selector modules plugged into those positions. This allows the selector modules to be interchanged. It also enables two selector modules to operate simultaneously, if required, for up to eight-pole switching. Each of the ten selector module positions is addressed by a signal at a pin in the selector module address link area. Opposite these pins is another set of ten pins which carry signals representing a decode of the tens decade of channel identity. By linking between the two sets of pins, each selector module can be allocated a particular tens address.

The selector module address pins will normally be linked as shown in Fig. 5. This arangement will allow 100 channels of guarded 2 or 3 pole switching, depending on whether a 3 or 4 pole selector module is utilised.

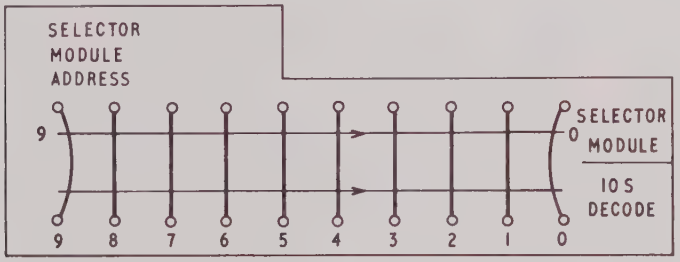


Fig. 5 Selector Module Address: Standard Linking

If different selector module addressing is required, the linking must be changed accordingly. For example, if 20 channels of guarded 3 pole switching and 40 channels of guarded 6 pole switching are required, then two selector modules must operate singly and eight in pairs. The 3 pole channels could be 00 to 19, and the 6 pole channels could be 20 to 59. Fig. 6 shows the necessary linking to achieve this.

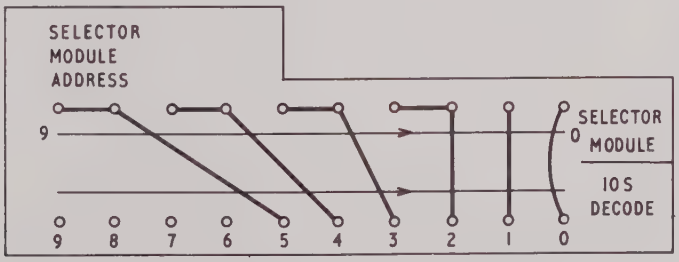


Fig. 6 Selector Module Address: Relay Pair Linking

With this arrangement a total of 60 channels are available. If more are required, a second scanner can be given the same hundreds address as the first and arranged to contain channels in the group 60 to 99 (see Section 4, Multiple Scanners). The appropriate linking for the second scanner is shown in Fig. 7.

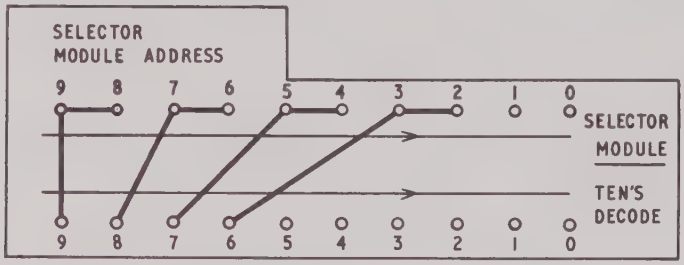


Fig. 7 Selector Module Address: Second Scanner Linking

Signal Conditioning

Signal conditioning can be applied to selected channels either by links on this interface or by program selectors 3308 or 3309.

In many systems, groups of channels may have the same type of transducer inputs and therefore are likely to require the same signal conditioning. Programming for this is determined by the "Signal Conditioning for Selector Module" links. In addition to direct voltage measurement, two types of conditioning are programmable, namely, thermocouple cold junction compensation types 1 and 2. On the link area, pins C1 and C2 represent conditioning for thermocouple type 1 and thermocouple type 2, respectively. Pins 0 to 9 represent the tens address of the selector module to which the conditioning can be applied. Each of these address pins can have one link to one of the two 'conditioning' pins. If an address pin is not linked to a 'conditioning' pin, channels of that module will be available for voltage measurement (no conditioning). If the ALL pin is linked to a 'conditioning' pin, all channels of the scanner will receive that signal conditioning.

For example, in a scanner having a hundreds address of 0, it is required to use channels 000 to 059 for voltage measurement, channels 060 to 079 for thermocouple type 2, channels 080 to 089 for thermocouple type 1 and channels 090 to 099 for voltage measurement. The appropriate linking for this requirement is shown in Fig. 8.

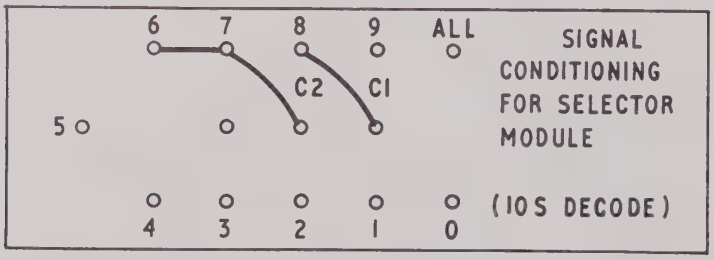


Fig. 8 Signal Conditioning Linking for Blocks of Ten Channels

NOTE:- No *signal conditioning for selector module* links should be fitted for input selectors on which signal conditioning is programmed by a 3308 or 3309 Program Selector.

If conditioning to groups of ten channels is required, but easy selection of this facility is desirable, the use of a 3308 program selector is recommended.

If conditioning of individual channels is required a 3309 program selector must be used.

Call Program from Channel Address

The channel address from the scanner controller becomes the program address via the 'call program from channel address' links (Fig. 9). These links enable the user to call logger programs from channel address, without the use of program selector panels.

Any one or two decades of program address can be produced from the three decades of channel address, in any combination. The linking examples in Figs. 10 to 13 cover the more general requirements and are each illustrated by two diagrams. Diagram 'a' is a simplified theoretical one, whilst diagram 'b' shows the equivalent physical linking requirements.

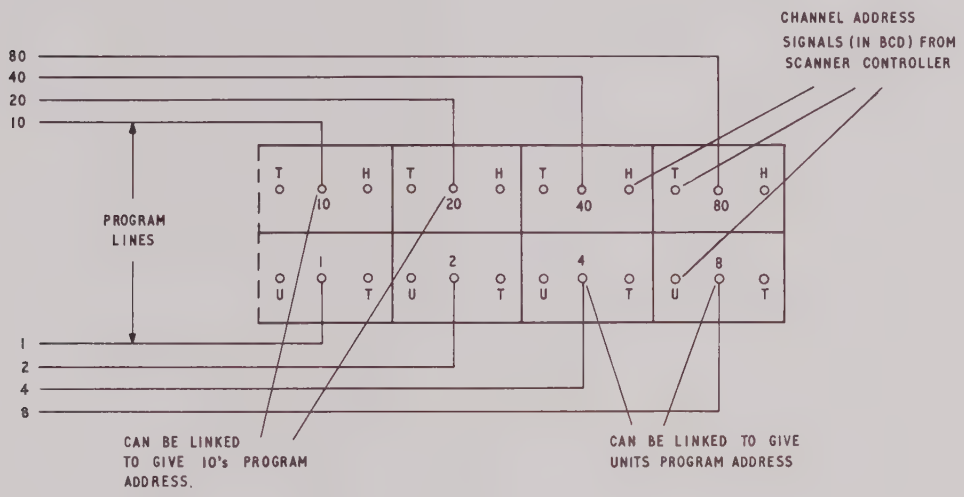


Fig. 9 Call Program from Channel Address Links

Note:

(1) If a program selector panel is used it will override the corresponding program defined in this area.

(2) A link between the INHIBIT pin and the C/R pin inhibits all programs called by links in this area.

Linking Examples

1. In this example it is required that programs are called by the tens and units of channel address, i.e. independent of the hundreds decade. This means that the same series of programs will be called for every hundreds decade of channel address received by the scanner, e.g. the same program will be called from channel addresses 019, 119, 219, 319, etc. The appropriate linking is shown in Fig. 10.

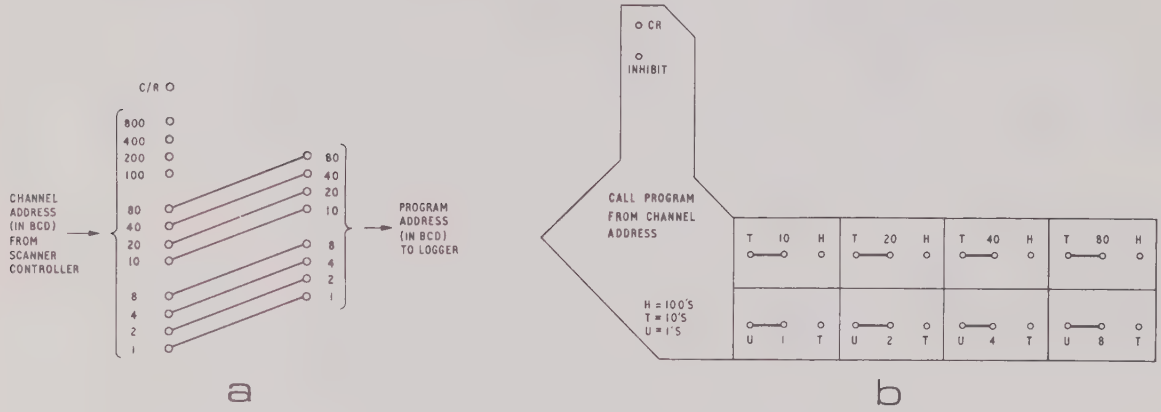


Fig. 10 Linking for Least Significant Two Decades of Channel Address

2. In this example it is required to call programs from the hundreds and tens of channel address, i.e. independently of the units decade. This means that, on a particular scanner, a separate program can be called for each block of ten channels. For example, the program addresses called for channel blocks 000 - 009, 010 - 019, and 020 - 029 are 00, 01, and 02, respectively. Fig. 11 shows the necessary linking.

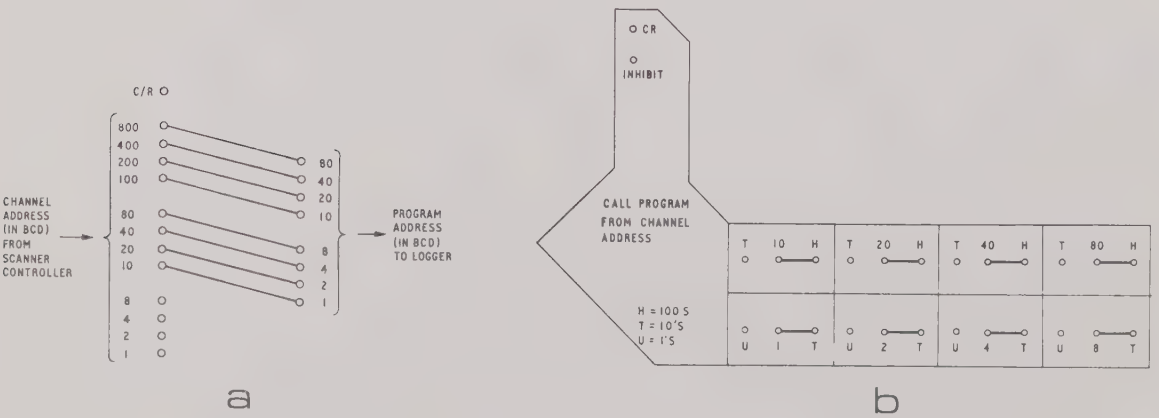


Fig. 11 Linking for Most Significant Two Decades of Channel Address

3. This example is similar to example 2, in that a separate program is called for each block of ten channels. In this case, however, the tens decade of program address is not called by the channel address, but is fixed at '30'. This is achieved by negating the '80' and '40' of program address and leaving '20' and '10' active. Hence the program addresses called for channel blocks '00 - '09, '10 - '19, '20 - '29, etc, will be 30, 31, 32, etc, respectively, for any scanner, regardless of its hundreds address. The appropriate linking is shown in Fig. 12.

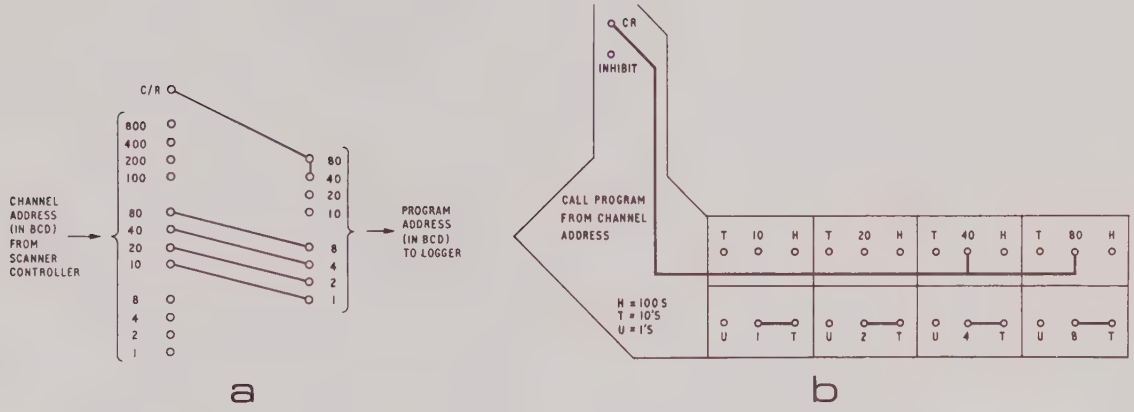


Fig. 12 Negating Link for 40 and 80 BCD Program Address

4. As a further example of that given in 3, programs 80 to 89 are required (one program per selector module). The 8 of the tens decade is generated independently of channel address by using the CR pin to negate 10, 20 and 40 of the bcd program address. Fig. 13 shows the necessary linking.

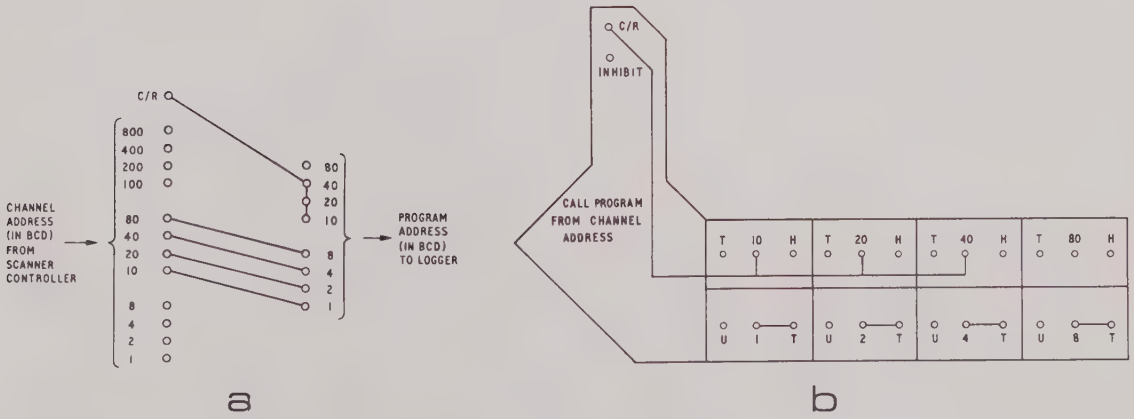
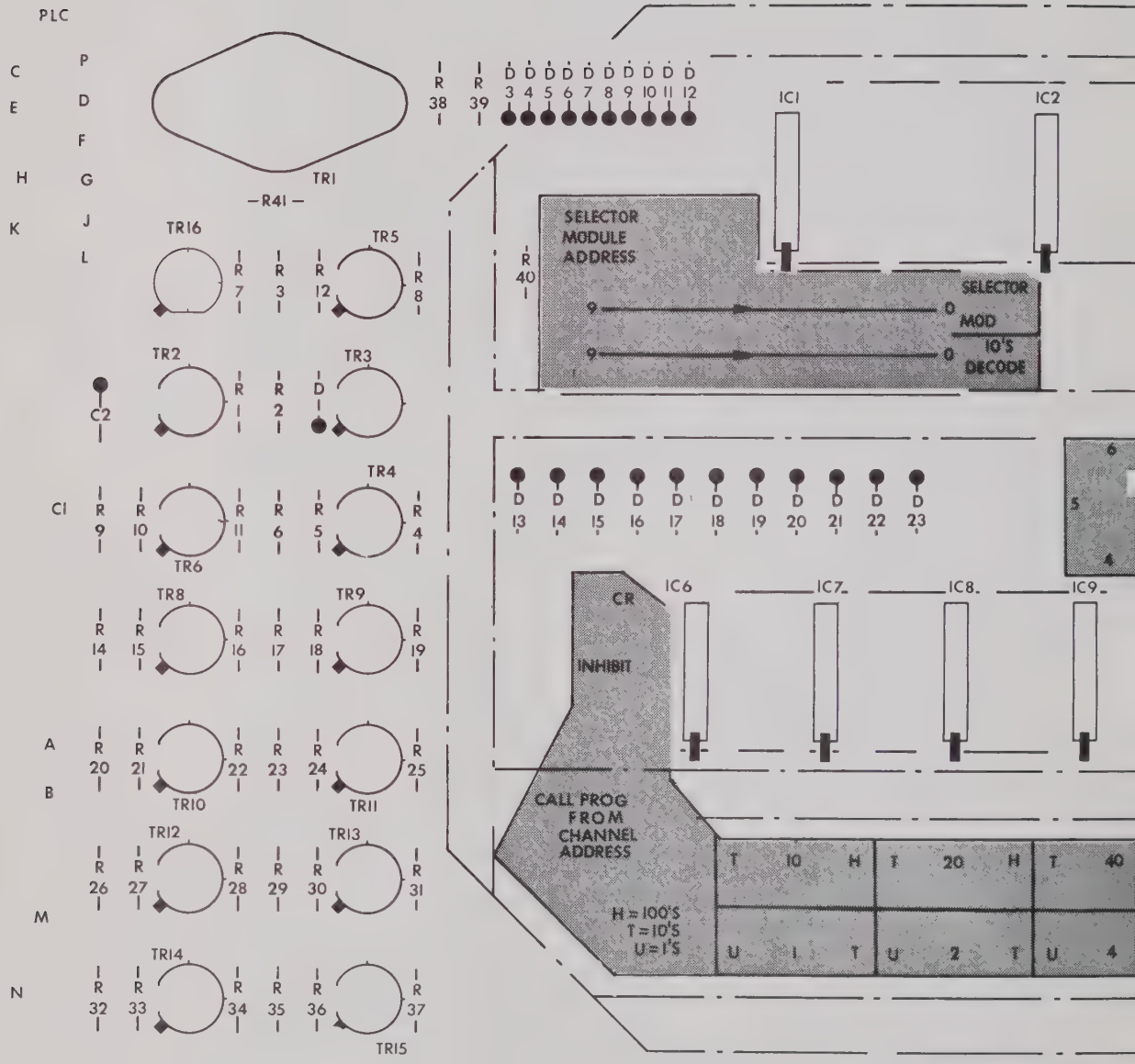


Fig. 13 Negating Link for 10, 20 and 40 BCD Program Address

Note: If it is desired to allocate only one program to a scanner this can be achieved by simply negating the relevant pins of program address as described in Examples 3 and 4, leaving the channel address pins unlinked.


PLC
C
E
H
K
P
D
F
G
J
L
TR1
R41
TR16
TR5
TR2
TR3
C2
TR4
C1
TR6
TR8
TR9
A
B
TR10
TR11
TR12
TR13
M
TR14
N
TR15
R 38
R 39
D 3 4 5 6 7 8 9 10 11 12
IC1
IC2
R 40
SELECTOR MODULE ADDRESS
9
0
SELECTOR MOD
10'S DECODE
D 13 14 15 16 17 18 19 20 21 22 23
6
5
4
CR
INHIBIT
IC6
IC7
IC8
IC9
CALL PROG FROM CHANNEL ADDRESS
H = 100'S
T = 10'S
U = 1'S
T 10 H
T 20 H
T 40
U 1 T
U 2 T
U 4

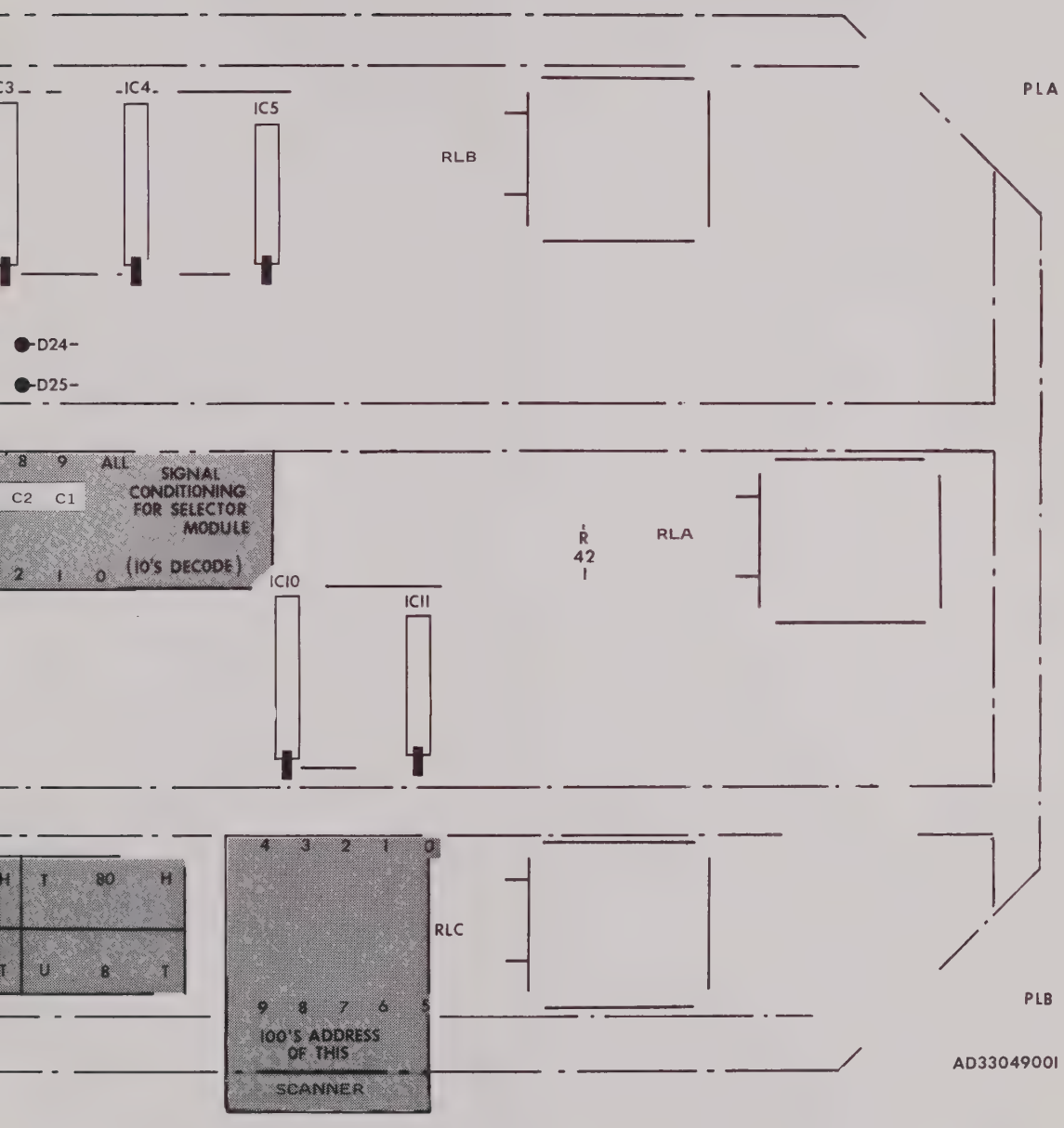


Fig. 14 Interface Linking Diagram

COMPONENT PARTS LIST

ABBREVIATIONS

Circuit References

B	Battery
C	Capacitor (μF)
CSR	Thyristor
D	Diode
FS	Fuse
IC	Integrated Circuit
L	Inductor
LP	Lamp (including Neon)
LK	Link
M	Meter
MSP	Mains Selector Panel
PL	Plug
R	Resistor (Ω)
RL	Relay
S	Switch
SK	Socket
T	Transformer
TP	Terminal Post (or Test Point)
TR	Transistor
V	Valve
X	Other Components

Also Used:-

RNL	Non Linear Resistor (Ω)
RV	Variable Resistor (Ω)

Component Composition

FIXED RESISTORS

Carbon Composition	CACP
Carbon Film	CAFM
Cracked Carbon	CKCA
Metal Film	MEFM
Metal Oxide	MEOX
Power Wirewound	POWW
Precision Wirewound	PRWW
Temperature Sensitive	TEMP
Thick Film	TKFM
Thin Film	TNFM
Voltage Sensitive	VOLT

Component Composition (Cont'd)

VARIABLE RESISTORS

Wirewound Preset Single Turn	WWPS
Wirewound Preset Multiturn	WWPM
Wirewound Front Panel Single Turn	WWFS
Wirewound Front Panel Multiturn	WWFM
Carbon Preset Single Turn	CAPS
Carbon Preset Multiturn	CAPM
Carbon Front Panel Single Turn	CAFS
Carbon Front Panel Multiturn	CAFM
Cermet Preset Single Turn	CMPS
Cermet Preset Multiturn	CMPM
Cermet Front Panel Single Turn	CMFS
Cermet Front Panel Multiturn	CMFM

CAPACITORS

Air	AIR
Aluminium Electrolytic	ALME
Aluminium Solid	ALMS
Polycarbonate	CARB
Ceramic	CERM
Polyester Foil	ESTF
Polyester Metallised	ESTM
Glass	GLAS
Mica	MICA
Metallised Lacquer	MLAC
Paper Foil	PAPF
Paper Metallised	PAPM
PTFE	PTFE
Polypropylene Film	PYLN
Polystyrene	STYR
Tantalum Dry	TAND
Tantalum Foil	TANF
Tantalum Wet	TANW

HUNDREDS DECODE:

The HUNDREDS DECODE converts the 'hundreds' decade of channel address from BCD to baseless decimal form and, when this corresponds with the position of the 'hundreds address of this scanner' link, issues a Lo enabling signal to Vcc SWITCHING and SKIP/ ACCEPT CHANNEL DECODE and a Hi enabling signal to TENS DECODE AND DRIVE. Also, a Lo 'hundreds detail' signal is routed from IC1, pins 2 and 4, to each Input Selector in the Scanner, where it is used for power gating and channel program enabling (3308).

Vcc SWITCHING:

To minimise the current drain of the system +9V supply, the Vcc supply most of the circuit elem of the 3304 Control Int face, and to the 3310 C Junction Compensator, switched off while the Scanner is not being ad ressed. This is achieved by switching off transis TR1 with a Hi from the HUNDREDS DECODE

TENS DECODE A DRIVE:

The TENS DECO DRIVE network tional only while 'hundreds decode pins 4, 2, 10 and quadruple NAND is Hi. This allows 'tens' decade of c address to be app the form '1' = Hi, to the inputs of B decimal converter baseless decimal c IC3 is used to con 'tens drive' lines, lines called depen the configuration

CHANNEL ADDRESS BUFFERING:

The BCD channel address ('1' = Lo, '0' = Hi) from the Scanner Controller is processed initially by the CHANNEL ADDRESS BUFFERING network. This has two groups of channel address outputs. One group, in which the logic sense is inverted to '1' = Hi, '0' = Lo, is applied to the PROGRAM ADDRESSING network, while the other group, in which the logic sense of the 'hundreds' decade alone is inverted, is split into its three component decades for application to the HUNDREDS DECODE, the TENS DECODE AND DRIVE, and the 'units drive' lines to the 3305/3 Input Selectors.

PROGRAM ADDRESSING

The action of the PROGRAM ADDRESSING network depends on the state of the 'override' input, pin 20, PLC. If this is Hi, signifying that a Program Selector is not in use on the channel being addressed, then NAND gates IC6 and IC7 are enabled, thus allowing the three decade channel addresses ('1' = Hi, '0' = Lo) from CHANNEL ADDRESS BUFFERING to call up a two decade program address. The program address called is determined by the 'call program from channel address' links, which are connected as detailed in Section 5.1.

NAND gates IC6 and IC7 apply the program address in the form '1' = Lo, '0' = Hi to the inputs of inverter drivers TR8 - TR15, which invert it to the form '1' = Hi, '0' = Lo, for application to the 3353 Scanner Controller.

If the 'override' input is Lo, signifying that a Program Selector is in use, then NAND gates IC6 and IC7 are inhibited. This leaves inverter drivers TR8 - TR15 free to respond to the two decades of program address ('1' = Lo, '0' = Hi) from the Program Selector.

SCANNER Vcc SUPPLY:

The Scanner Vcc supply is obtained from a 5V regulator mounted on the Scanner chassis. Connections to the regulator from the external power supply and from the regulator to the Scanner modules are routed through the 3304 Control Interface. To minimise the current drawn by the Scanner, the Vcc supply to the majority of circuit elements is switched on only when the module containing them responds to a channel address (See Vcc SWITCHING on this diagram and on circuit diagram relating to board 33059001 of the Input Selector).

'selector module address' links. These links connect the decimal outputs of IC3 to the inputs of the inverting 'tens drive' amplifiers, IC1, IC2. As each decimal output is taken Lo in turn, the 'tens drive' line(s) serviced by the amplifier(s) linked to it are taken Hi to call the appropriate input selector(s).

The Lo decimal outputs of IC3 are also used by the COLD JUNCTION COMPENSATION ENCODE, direct.

COLD JUNCTION COMPENSATION ENCODE:

When set to do so by the 'signal conditioning for selector module' links, the COLD JUNCTION COMPENSATION network issues either an individual compensation command for each Input Selector or one that is common to all. In the first case, links are connected to link pins 'C1', 'C2' or 'C3' in wired OR fashion from link pins '0' to '9', while in the second case a link is simply connected between link pin 'C1', 'C2' or 'C3' and link pin 'ALL'.

SKIP/ACCEPT CHANNEL DECODE:

The SKIP/ACCPET CHANNEL DECODE checks the availability of each channel addressed and issues a corresponding 'skip/accept channel' signal (Hi = skip, Lo = accept) to the Scanner Controller.

A channel address is accepted only when all the following conditions are satisfied:

'hundreds detail' input to TR2 emitter Lo, signifying 'scanner called';
one 'tens drive' input to D3 - D12 Hi, signifying Input Selector called is present in Scanner;
'unit skip' input to TR6 base Hi, signifying 'no skip programmed'.

This signal combination switches TR2 on and TR6 off. The resulting Lo at the junction of R11 and D1 switches TR4 off and TR3 on to issue a Lo 'accept channel' signal, while a second Lo, issued from TR2 collector, switches on the ANALOGUE BUS ISOLATION relay driver.

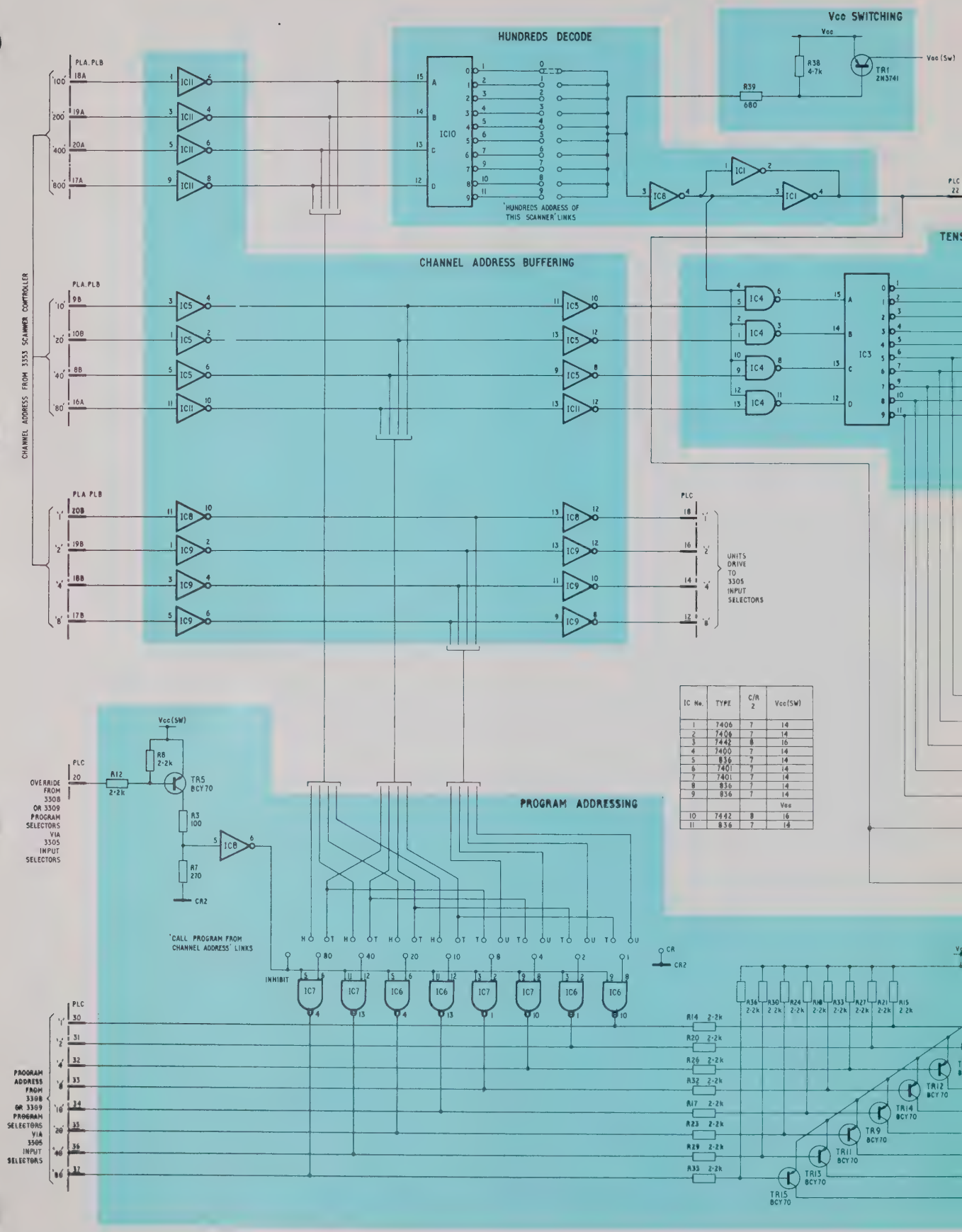
A 'channel skip' can be effected in three ways:

Units Skip - If a Skip Selector or a Program Selector takes the 'unit skip' input to the base of TR6 Lo then this transistor is switched on. This results in TR4 and TR3 being switched to their 'on' and 'off' states, respectively, to produce a Hi 'skip channel' signal at TR3 collector.

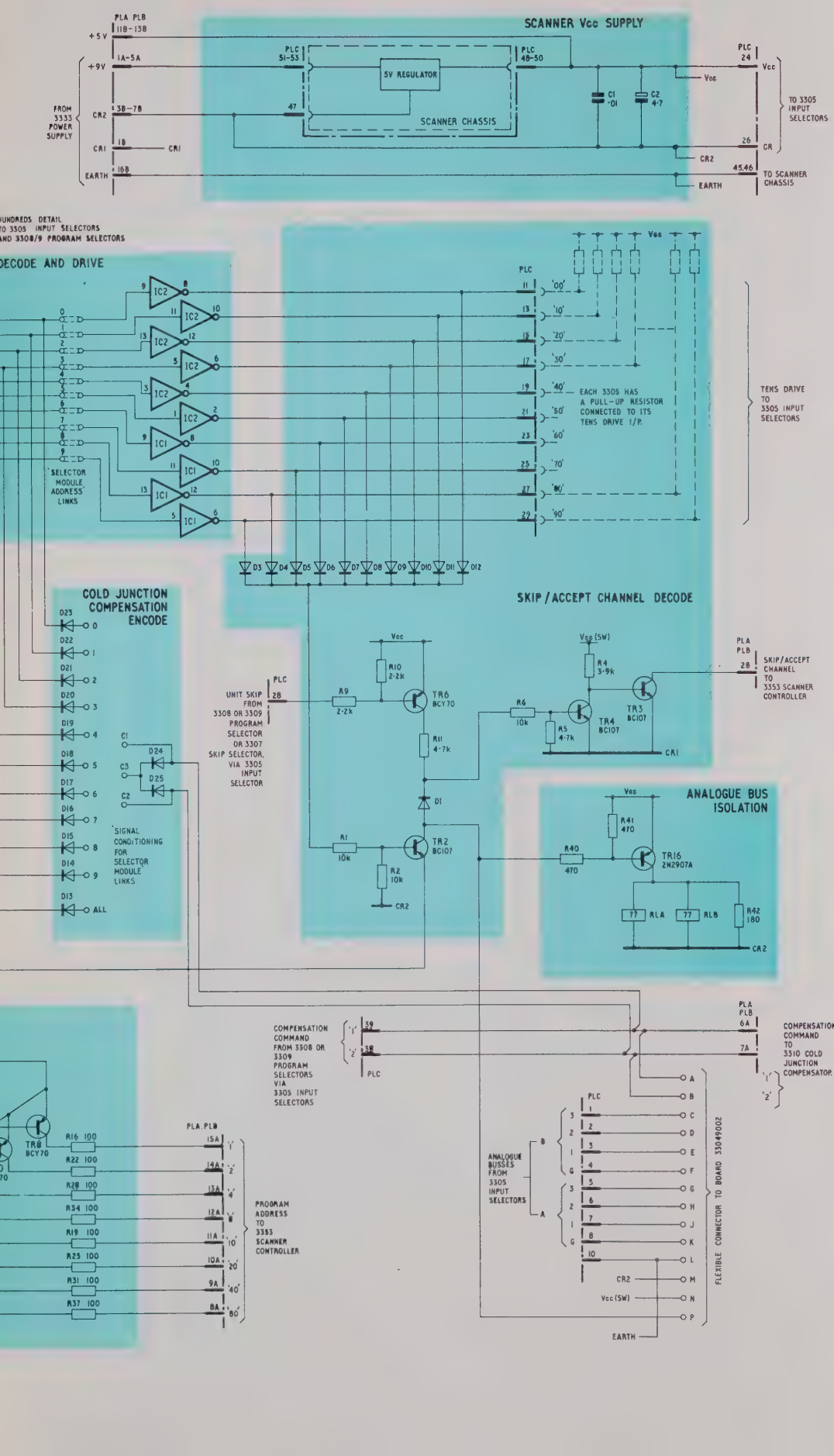
Tens Skip - Each of the drive amplifiers, IC1, IC2, in the TENS DECODE 'AND DRIVE is of an open collector type, having a pull-up resistor mounted in the Input Selector that is driven by it. Hence if an Input Selector is absent from the Scanner when addressed then the output of the associated drive amplifier remains Lo, causing TR2 in the SKIP/ACCEPT CHANNEL DECODE to be switched off. This allows diode D1 to conduct and results in TR4 and TR3 being switched to their 'on' and 'off' states, respectively, to produce a Hi 'skip channel' signal at TR3 collector.

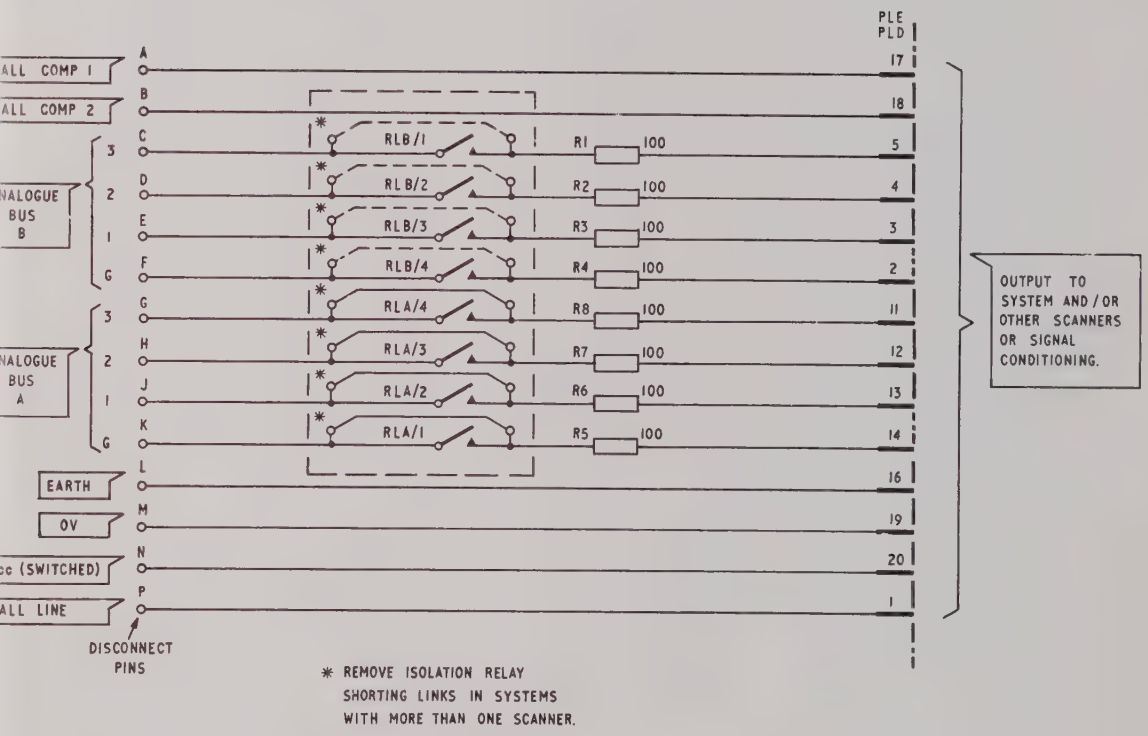
Hundreds Skip - If the HUNDREDS DECODE does not respond to the 'hundreds' decade of channel address then the hundreds detail input to TR2 emitter goes Hi, switching this transistor off and allowing diode D1 to conduct through R5, R6, R40 and R41. Also, by virtue of the Vcc SWITCHING transistor TR1, the Vcc supply to TR4 is switched off. These two actions combine to switch off TR3 and result in a Hi 'skip channel' signal being produced at the collector of this transistor.

The ANALOGUE BUS ISOLATION driver, TR16 is switched off for a 'hundreds' or 'tens' skip, but not for a 'units' skip. This is due to the action of diode D1 in preventing a Hi from TR6 collector reaching TR16 base.



IC No.	TYPE	C/R 2	Vcc(SW)
1	7406	7	14
2	7406	7	14
3	7442	8	16
4	7400	7	14
5	836	7	14
6	7401	7	14
7	7401	7	14
8	836	7	14
9	836	7	14
			Vcc
10	7442	8	16
11	836	7	14


SCANNER Vcc SUPPLY
PLA PLB 11B-13B
+5V
+9V
1A-5A
FROM 3333 POWER SUPPLY
CR2
3B-7B
CR1
1B
EARTH
16B
PLC 51-53
PLC 48-50
5V REGULATOR
SCANNER CHASSIS
47
C1 ·01
C2 4·7
PLC 24
Vcc
Voc
TO 3305 INPUT SELECTORS
26
CR
CR2
45,46
TO SCANNER CHASSIS
EARTH
HUNDREDS DETAIL TO 3305 INPUT SELECTORS AND 3308/9 PROGRAM SELECTORS
DECODE AND DRIVE
IC2
IC1
SELECTOR MODULE ADDRESS LINKS
PLC
'00'
'10'
'20'
'30'
'40'
'50'
'60'
'70'
'80'
'90'
EACH 3305 HAS A PULL-UP RESISTOR CONNECTED TO ITS TENS DRIVE I/P.
TENS DRIVE TO 3305 INPUT SELECTORS
D3 D4 D5 D6 D7 D8 D9 D10 D11 D12
COLD JUNCTION COMPENSATION ENCODE
D23 D22 D21 D20 D19 D18 D17 D16 D15 D14 D13
ALL
C1 C3 C2
D24 D25
SIGNAL CONDITIONING FOR SELECTOR MODULE LINKS
SKIP/ACCEPT CHANNEL DECODE
UNIT SKIP FROM 3308 OR 3309 PROGRAM SELECTOR OR 3307 SKIP SELECTOR, VIA 3305 INPUT SELECTOR
PLC 28
R9 2·2k
R10 2·2k
TR6 BCY70
R11 4·7k
D1
R1 10k
R2 10k
TR2 BC107
CR2
Vcc
Vcc (SW)
R4 3·9k
R6 10k
R5 4·7k
TR4 BC107
TR3 BC107
CR1
PLA PLB 28
SKIP/ACCEPT CHANNEL TO 3353 SCANNER CONTROLLER
ANALOGUE BUS ISOLATION
R41 470
R40 470
TR16 2N2907A
77 RLA
77 RLB
R42 180
CR2
COMPENSATION COMMAND FROM 3308 OR 3309 PROGRAM SELECTORS VIA 3305 INPUT SELECTORS
'1' 39
'2' 38
PLC
PLA PLB 6A 7A
COMPENSATION COMMAND TO 3310 COLD JUNCTION COMPENSATOR
'1'
'2'
TR8 BCY70
R16 100
R22 100
R28 100
R34 100
R19 100
R25 100
R31 100
R37 100
PLA PLB 15A 14A 13A 12A 11A 10A 9A 8A
'1' '2' '4' '8' '10' '20' '40' '80'
PROGRAM ADDRESS TO 3333 SCANNER CONTROLLER
ANALOGUE BUSSES FROM 3305 INPUT SELECTORS
B
A
PLC
3 2 1 G
A B C D E F G H J K L M N P
CR2
Vcc (SW)
EARTH
FLEXIBLE CONNECTOR TO BOARD 33049002



Circuit Diagram 2 : Pcb 33049002

Circuit Diagram 1 ; Pcb 33059001

Component Parts List

for

Printed Circuit Board 33049001
(Scanner Interface 3304)

Cct Ref.	General Description				Solartron Part No.
R1	CACP	10k	1/4W	10%	172041000
R2	CACP	10k	1/4W	10%	172041000
R3	CACP	100	1/4W	10%	172021000
R4	CACP	3.9k	1/4W	10%	172033900
R5	CACP	4.7k	1/4W	10%	172034700
R6	CACP	10k	1/4W	10%	172041000
R7	CACP	270	1/4W	10%	172022700
R8	CACP	2.2k	1/4W	10%	172032200
R9	CACP	2.2k	1/4W	10%	172032200
R10	CACP	2.2k	1/4W	10%	172032200
R11	CACP	4.7k	1/4W	10%	172034700
R12	CACP	2.2k	1/4W	10%	172032200
R14	CACP	2.2k	1/4W	10%	172032200
R15	CACP	2.2k	1/4W	10%	172032200
R16	CACP	100	1/4W	10%	172021000
R17	CACP	2.2k	1/4W	10%	172032200
R18	CACP	2.2k	1/4W	10%	172032200
R19	CACP	100	1/4W	10%	172021000
R20	CACP	2.2k	1/4W	10%	172032200
R21	CACP	2.2k	1/4W	10%	172032200
R22	CACP	100	1/4W	10%	172021000
R23	CACP	2.2k	1/4W	10%	172032200
R24	CACP	2.2k	1/4W	10%	172032200
R25	CACP	100	1/4W	10%	172032200
R26	CACP	2.2k	1/4W	10%	172032200
R27	CACP	2.2k	1/4W	10%	172032200
R28	CACP	100	1/4W	10%	172021000
R29	CACP	2.2k	1/4W	10%	172032200
R30	CACP	2.2k	1/4W	10%	172032200
R31	CACP	100	1/4W	10%	172021000
R32	CACP	2.2k	1/4W	10%	172032200
R33	CACP	2.2k	1/4W	10%	172032200
R34	CACP	100	1/4W	10%	172021000
R35	CACP	2.2k	1/4W	10%	172032200
R36	CACP	2.2k	1/4W	10%	172032200
R37	CACP	100	1/4W	10%	172021000
R38	CACP	4.7k	1/4W	10%	172034700
R39	CACP	330	1/4W	10%	172023300
R40	CACP	470	1/4W	10%	172024700
R41	CACP	470	1/4W	10%	172024700
R42	CACP	180	1/4W	10%	172021800
C1	CERM	0.01	18V	−25% +50%	241841000
C2	TAND	4.7	10V	+10% −25%	265364700

Cct Ref.	General Description
D1 to D25	SD3
TR1	2N3741
TR2 to TR4	BC107S
TR5	BCY70
TR6	BCY70
TR8 to TR15	BCY70
TR16	2N2907A
IC1	SN7406N
IC2	SN7406N
IC3	SN7442N
IC4	SN7400N
IC5	SN15836N
IC6	SN7401N
IC7	SN7401N
IC8	SN15836N
IC9	SN15836N
IC10	SN7442N
IC11	SN15836N
RLA & RLB	Coil

Component Parts List

for

Printed Circuit Board 33049002
(Scanner Interface 3304)

Cct Ref.	General Description			
R1 to R8	CACP	100	1/4W	10%
RLA & RLB	Reed Insert			

Solartron
Part No.

300522160

300553050

300553320

300553590
300553590

300553590

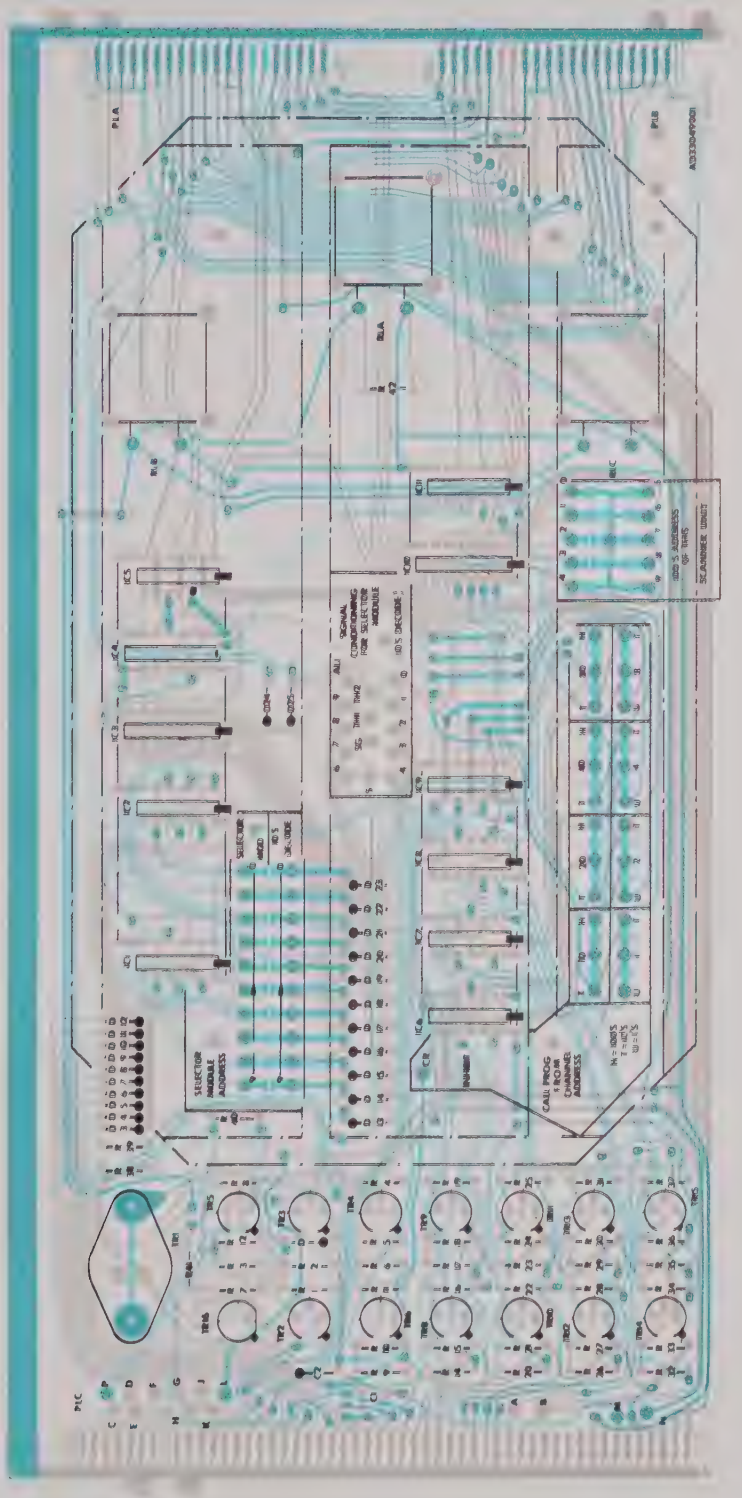
300554551

510000760
510000760
510000330
510000340

510000290
510000400
510000400
510000290

510000290
510000330
510000290

309501101



Solartron
Part No.

172021000

379602701

Fig. 15 Component Location; pcb 33049001

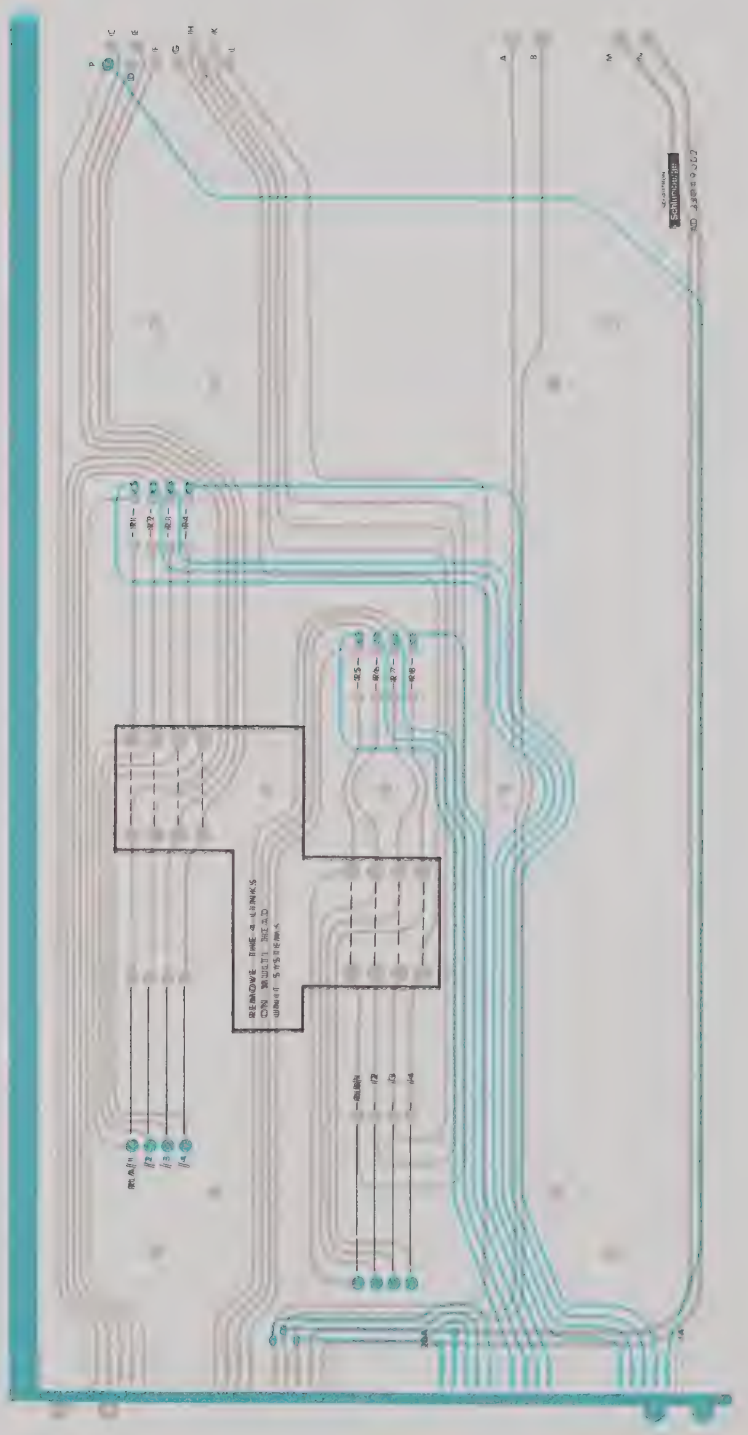


Fig. 16 Component Location; pcb 33049002

SECTION 5/2

Selector Modules 3303/3305

The purpose of the selector module is to connect analogue input signals to either of two common groups of output lines, when commanded by control signals. Each module contains 10 channels of switching. Selector 3303 provides 3-pole switching; selector 3305 provides 4-pole switching. The module type number is stated on the serial number label.

If a selector module is missing from its position, a signal will be issued from the scanner which will cause the control system to automatically skip the channels associated with that module.

Each selector module occupies 1½in. width in the scanner chassis and comprises two pcb's. One board contains only reed inserts (relay contacts); the other board contains the coils which operate the reed switches, and the associated drive circuitry (Fig. 1).

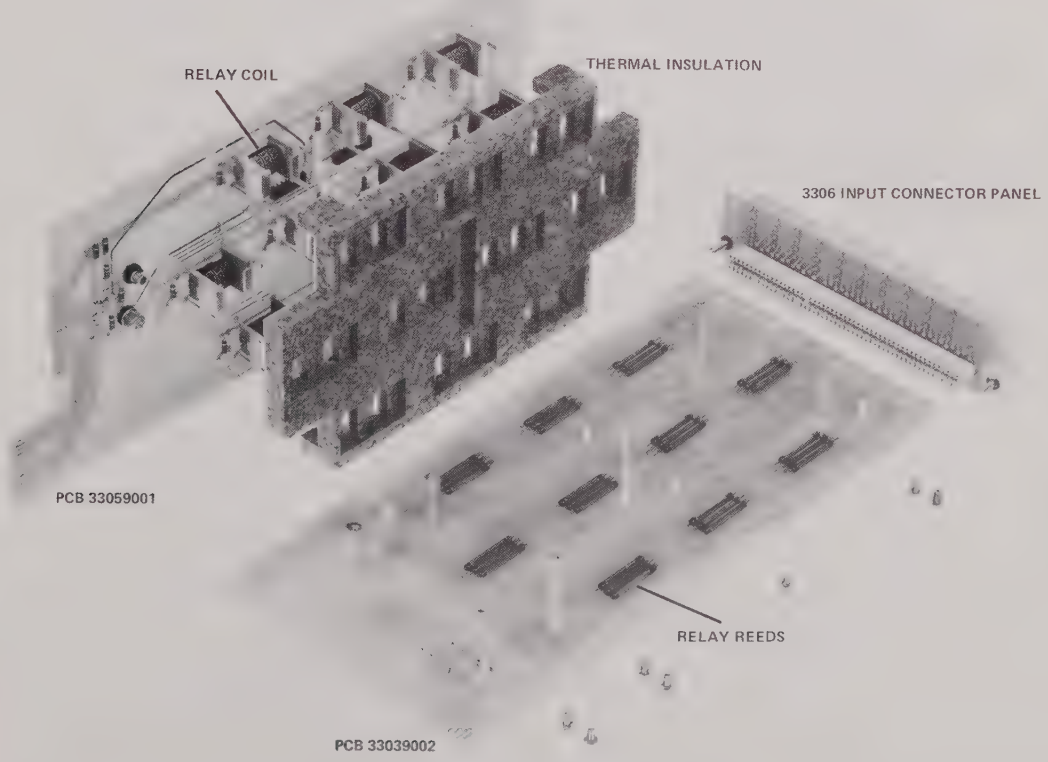


Fig. 1 Dismantled Selector Module

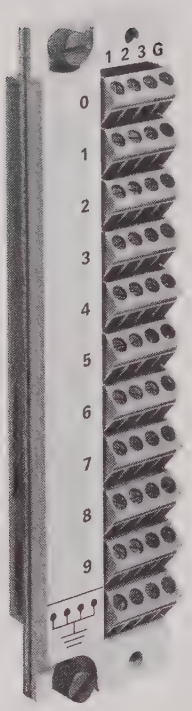


Fig. 2 Analogue Input Connector 3306

Analogue signal connections to each selector module are made via a removable connector panel (3306). Each panel contains 11 four-way screw terminal blocks. A terminal block is used for each channel and the eleventh block provides an earth connection (Fig. 2).

On the board containing the relay reeds are links which determine how the analogue signals are routed to Bus A and/or Bus B. If the application of the input selector is made known at the time of ordering, these links are connected as detailed on the Input Selector Linking Charts contained in Section 4: Installation; otherwise connection is made for emf, as shown in Fig. 3.

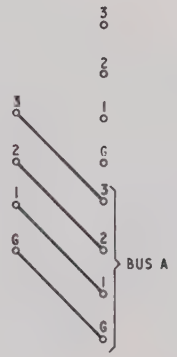


Fig. 3 Links for Bus A

FIELD TESTING AN INPUT SELECTOR

The following tests can be carried out, on site, to check the satisfactory operation of an input selector,

(a) when a fault is suspected and

(b) after replacement of a faulty component.

The test equipment required is a 3306 Input Connector panel connected up as shown in Figs. 4, 5 or 6 and, where the system contains no transducer energising source, a dc supply or battery box set to a voltage comparable with the transducer outputs. Where a system already uses 3306 Input Connectors, one or two of these can be wired up for test purposes. However, if the tests are likely to be carried out very often it will be found more convenient to have a spare pair of input connector panels permanently wired.

The purpose of the tests is to check,

(a) that the relay reeds operate and make good contact within a reasonable period and

(b) that the relay reeds release within a reasonable period.

A 'reasonable period' is one which allows the system to function correctly. The tests are not intended to check an input selector to the specification given in Section 3.

The test procedure is as follows:

1. Set the system to stand-by.

2. Locate the scanner containing the input selector to be tested and, if necessary, remove the 3310 Cold Junction Compensator from the rear, thus revealing the input connector panels.

3. Remove the input connector panel from the input selector to be tested, complete with transducer leads, and substitute test panel wired as shown in Fig. 4a, 5a or 6a, as appropriate.

4. Set the system to scan the channels multiplexed by the input selector under test and, using the system DVM, check that a steady reading is obtained for each channel. The magnitude of the DVM reading should be the same in each case, although the polarity will change every two channels due to the cross-connections on the test panel. Faults are indicated as follows:-

   (i) a reed which is slow to operate is indicated by an unsteady DVM reading on the second of two channels with the same polarity.

   (ii) a reed which is slow to release is indicated by a DVM reading of zero volts on the second of two channels of opposite polarity.

   (iii) a reed relay which is permanently closed is indicated by a DVM reading of zero volts on all channels of opposite polarity to that of the affected channel.

   (vi) a reed which does not make good contact is indicated by a low DVM reading.

Having found a fault on a particular channel or group of channels, identify the faulty reed(s) by inspection, substitution, or a continuity check with an ohmmeter or a lamp and battery.

5. Set the system to stand-by and substitute for the test panel plugged onto the input selector under test a panel wired as shown in Fig. 4b, 5b or 6b, as appropriate.

6. Set the system to scan the channels multiplexed by the input selector under test and, using the system DVM, check that a steady reading is obtained for each channel. The magnitude of the DVM reading should be the same in each case, although the polarity will change every two channels due to the cross-connections on the test panel. Faults are indicated as follows:-

   (i) a reed which is slow to operate is indicated by an unsteady DVM reading on the second of two channels with the same polarity.

   (ii) a reed which is slow to release is indicated by a DVM reading of zero volts on the second of two channels of opposite polarity.

   (iii) a reed relay which is permanently closed is indicated by a DVM reading of zero volts on all channels of opposite polarity to that of the affected channel.

   (vi) a reed which does not make good contact is indicated by a low DVM reading.

   Having found a fault on a particular channel or group of channels, identify the faulty reed(s) by inspection, substitution, or a continuity check with an ohmmeter or a lamp and battery.

7. Remove test panel 'b' from input selector under test and, if test was satisfactory, refit input connector panel carrying transducer leads.

8. If no further input selectors are to be tested in the scanner, refit the 3310 Cold Junction Compensator, where used.

NOTE: Due to the polarity change delay of the system DVM, these tests will not necessarily show up a reed release period which extends only partially into the next channel selection.

COMPONENT PARTS LIST

ABBREVIATIONS

Circuit References

B	Battery
C	Capacitor (μF)
CSR	Thyristor
D	Diode
FS	Fuse
IC	Integrated Circuit
L	Inductor
LP	Lamp (including Neon)
LK	Link
M	Meter
MSP	Mains Selector Panel
PL	Plug
R	Resistor (Ω)
RL	Relay
S	Switch
SK	Socket
T	Transformer
TP	Terminal Post (or Test Point)
TR	Transistor
V	Valve
X	Other Components

Also Used:-

RNL	Non Linear Resistor (Ω)
RV	Variable Resistor (Ω)

Component Composition

FIXED RESISTORS

Carbon Composition	CACP
Carbon Film	CAFM
Cracked Carbon	CKCA
Metal Film	MEFM
Metal Oxide	MEOX
Power Wirewound	POWW
Precision Wirewound	PRWW
Temperature Sensitive	TEMP
Thick Film	TKFM
Thin Film	TNFM
Voltage Sensitive	VOLT

Component Composition (Cont'd)

VARIABLE RESISTORS

Wirewound Preset Single Turn	WWPS
Wirewound Preset Multiturn	WWPM
Wirewound Front Panel Single Turn	WWFS
Wirewound Front Panel Multiturn	WWFM
Carbon Preset Single Turn	CAPS
Carbon Preset Multiturn	CAPM
Carbon Front Panel Single Turn	CAFS
Carbon Front Panel Multiturn	CAFM
Cermet Preset Single Turn	CMPS
Cermet Preset Multiturn	CMPM
Cermet Front Panel Single Turn	CMFS
Cermet Front Panel Multiturn	CMFM

CAPACITORS

Air	AIR
Aluminium Electrolytic	ALME
Aluminium Solid	ALMS
Polycarbonate	CARB
Ceramic	CERM
Polyester Foil	ESTF
Polyester Metallised	ESTM
Glass	GLAS
Mica	MICA
Metallised Lacquer	MLAC
Paper Foil	PAPF
Paper Metallised	PAPM
PTFE	PTFE
Polypropylene Film	PYLN
Polystyrene	STYR
Tantalum Dry	TAND
Tantalum Foil	TANF
Tantalum Wet	TANW

CAUTION The test panels shown in Figs. 4, 5 and 6 are intended only for testing input selectors having the standard analogue bus linking detailed in Input Selector Linking Charts 1, 2 and 3, respectively, in Section 4. For input selectors having non-standard analogue bus linking, special test panels can be made up, but this should only be undertaken by, or under the guidance of, an experienced engineer.

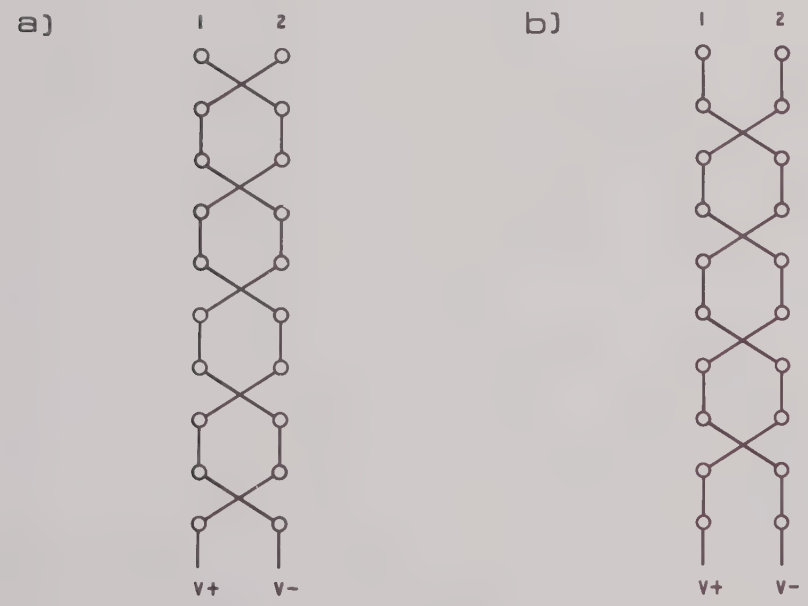


Fig. 4 2 pole Testing ; Emf Only.

Fig. 6 ⟶

The test panels shown in Figs 5 and 6 utilise the system constant current supply, which is applied via a 3319 or 3329 cable as usual. Resistor R should have a resistance comparable with that of the transducers normally multiplexed by the input selector under test.

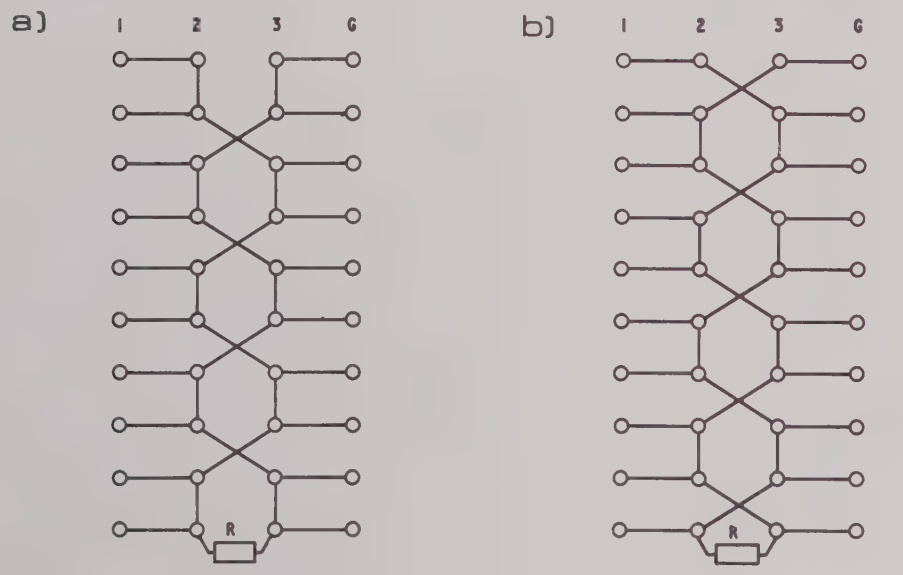


Fig. 5 4 pole Testing ; Platinum Resistance Thermometers, etc. (see Input Selector Linking Chart 2).

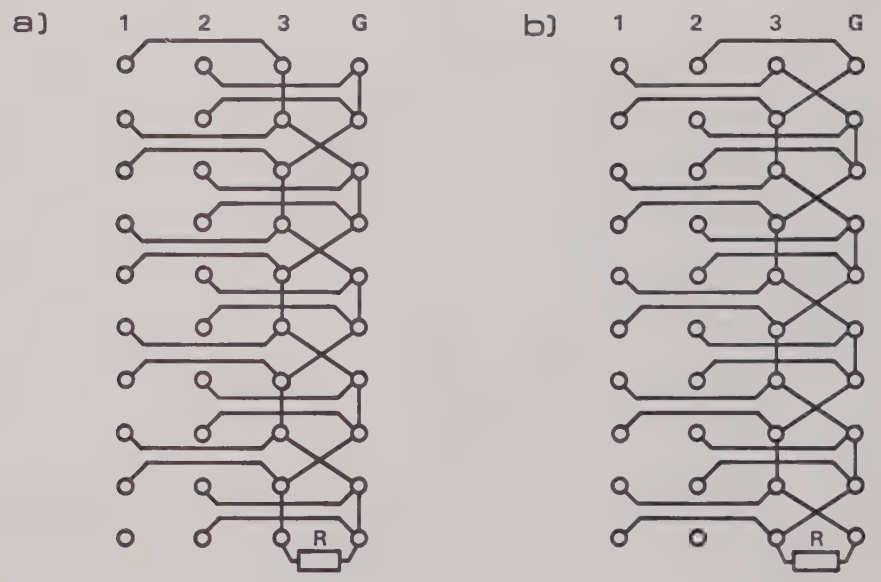


Fig. 6 4 pole Testing ; Strain Gauge Bridges (see Input Selector Linking Chart 3).

REED ENERGISATION:

When a coil is energised the magnetic field produced closes an associated group of reed contracts on the analogue switching board. To prevent a high reverse voltage emf being generated during coil de-energisation, each coil has connected across it a 270Ω resistor.

TENS PULL-UP:

See SKIP/ACCEPT CHANNEL DECODE description, section 5/1, page 5/1.10.

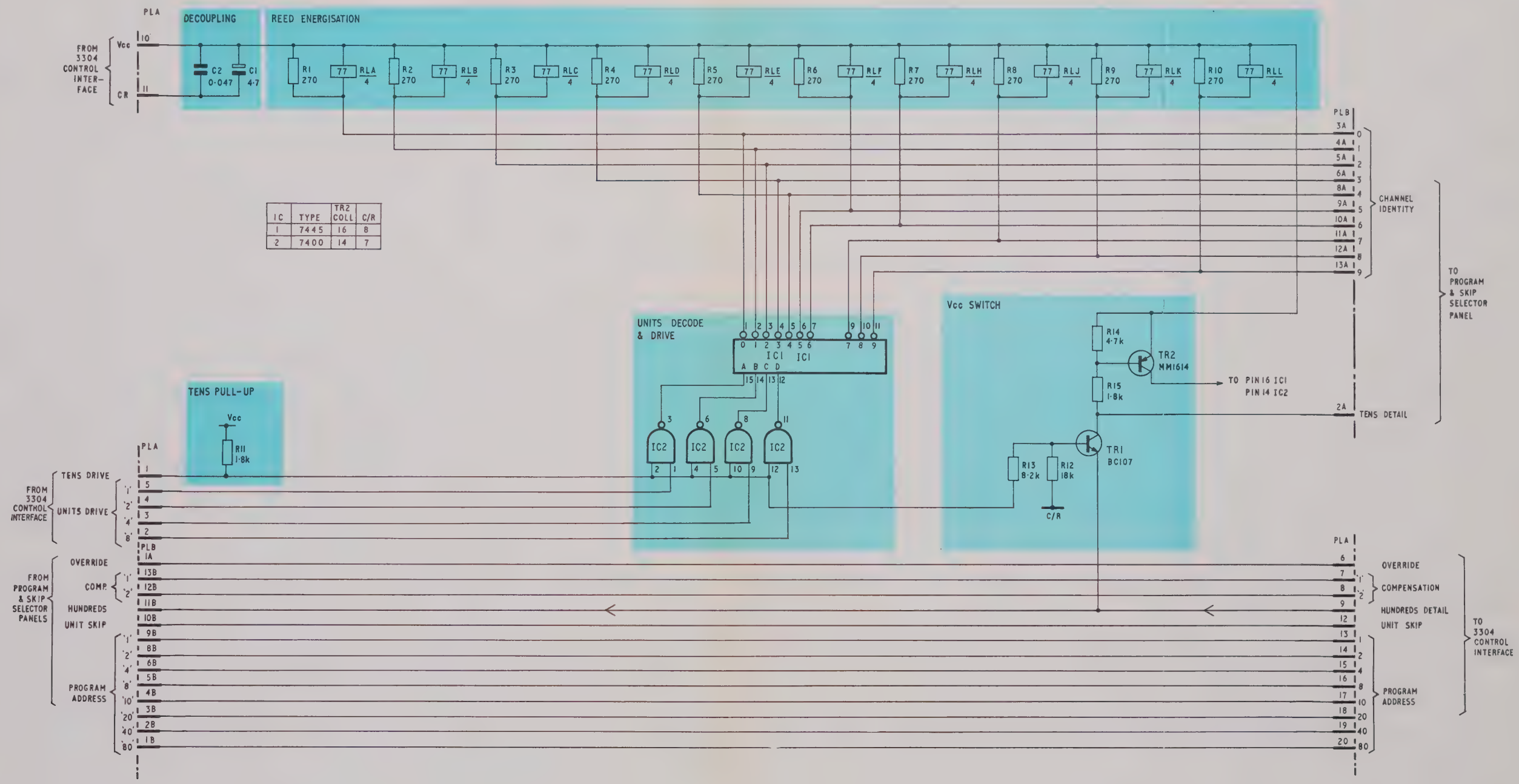
UNITS DECODE AND DRIVE:

The UNITS DECODE AND DRIVE network is functional only when the tens drive input is Hi, thus enabling the four NAND elements in IC2. These elements then respond to the BCD 'units' address ('1' = Lo, '0' = Hi), applying an inverted version of this to the inputs of BCD to Decimal Converter IC1. The resulting Lo decimal output of IC1 energises the appropriate REED ENERGISATION coil and 'channel identity' line.

When the 'tens drive' input is Lo it forces the output of each IC2 NAND element Hi, thus applying BCD 'fifteen' to IC1. Since this is an 'invalid' input, all the outputs of IC1 remain Hi and no coils are energised.

Vcc SWITCH:

To minimise the current drawn from the 5V regulator 'IC1 on the Scanner chassis, the Vcc supply to logic elements IC1 and IC2 in UNITS DECODE AND DRIVE is switched on, via TR2, only while the 3305 Input Selector is responding to its particular group of channel addresses. During this time TR1 is switched on by a Lo 'hundreds detail' input to its emitter and a Hi 'tens drive' input to its base, the resulting Lo at its collector holding TR2 fully on. At all other times TR1 is switched off by a Lo tens drive input, causing TR2 to be switched off also.



Circuit Diagram 1: Pcb 33059001

Component Parts List

for

Printed Circuit Board 33059001
(Scanner Selector 3305)

Cct Ref.	General Description				Solartron Part No.
R1 to R10	CACP	270	1/4W	10%	172022700
R11	CACP	1.8k	1/4W	10%	172031800
R12	CACP	18k	1/4W	10%	172041800
R13	CACP	8.2k	1/4W	10%	172038200
R14	CACP	4.7k	1/4W	10%	172034700
R15	CACP	1.8k	1/4W	10%	172031800
C1	TAND	4.7			265364700
C2	CERM	0.01			241841000
TR1	BC107				300553320
TR2	MM1614				300551670
	Transistor PAD (for use with TR1, TR2)				300584090
IC1	SN7445N				510000900
IC2	SN7400N				510000340
RLA to RLL	Coil				309501101

Component Parts List

for

Printed Circuit Board 33059002
(Scanner Selector 3305)

Cct Ref.	General Description	Solartron Part No.
RLA to RLL	Reed Insert	379602701

Component Parts List

for

Scanner Connector Panel 3306

Cct Ref.	General Description	Solartron Part No.
SKA	53 way connector	352553010
SKB to SKP	4 way strip terminal	355604060

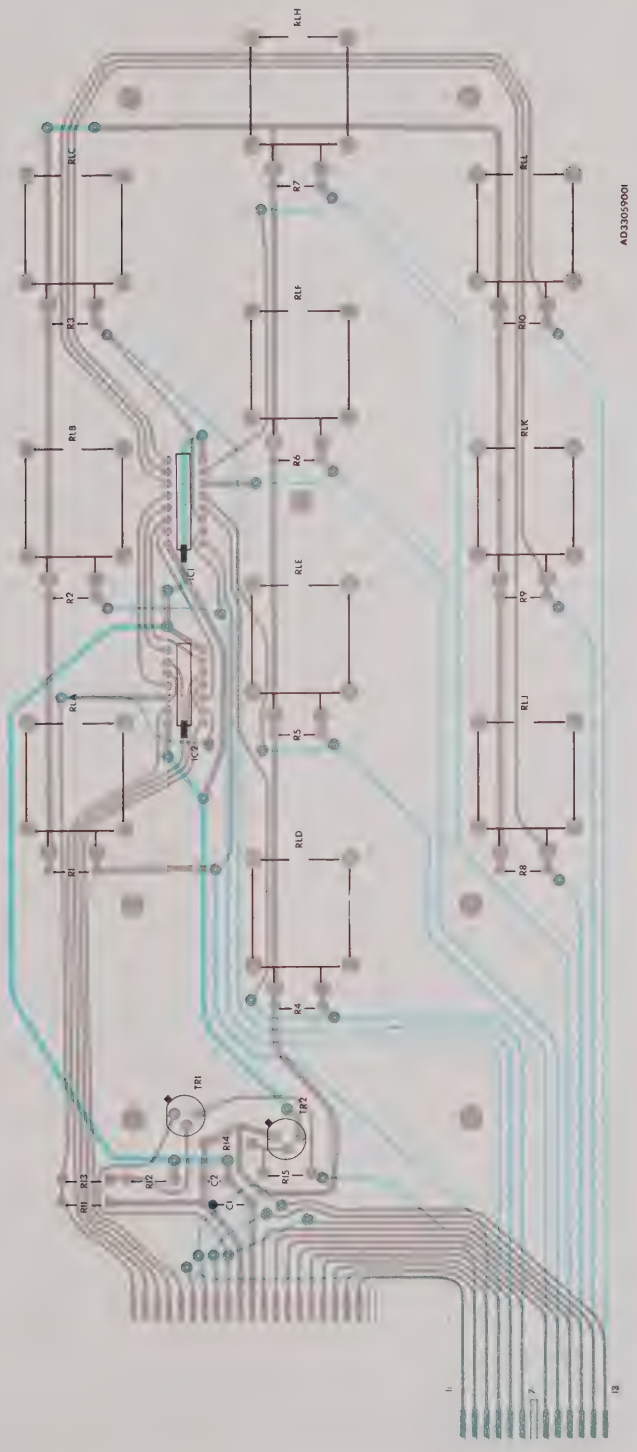


Fig. 7 Component Location ; pcb 33059001

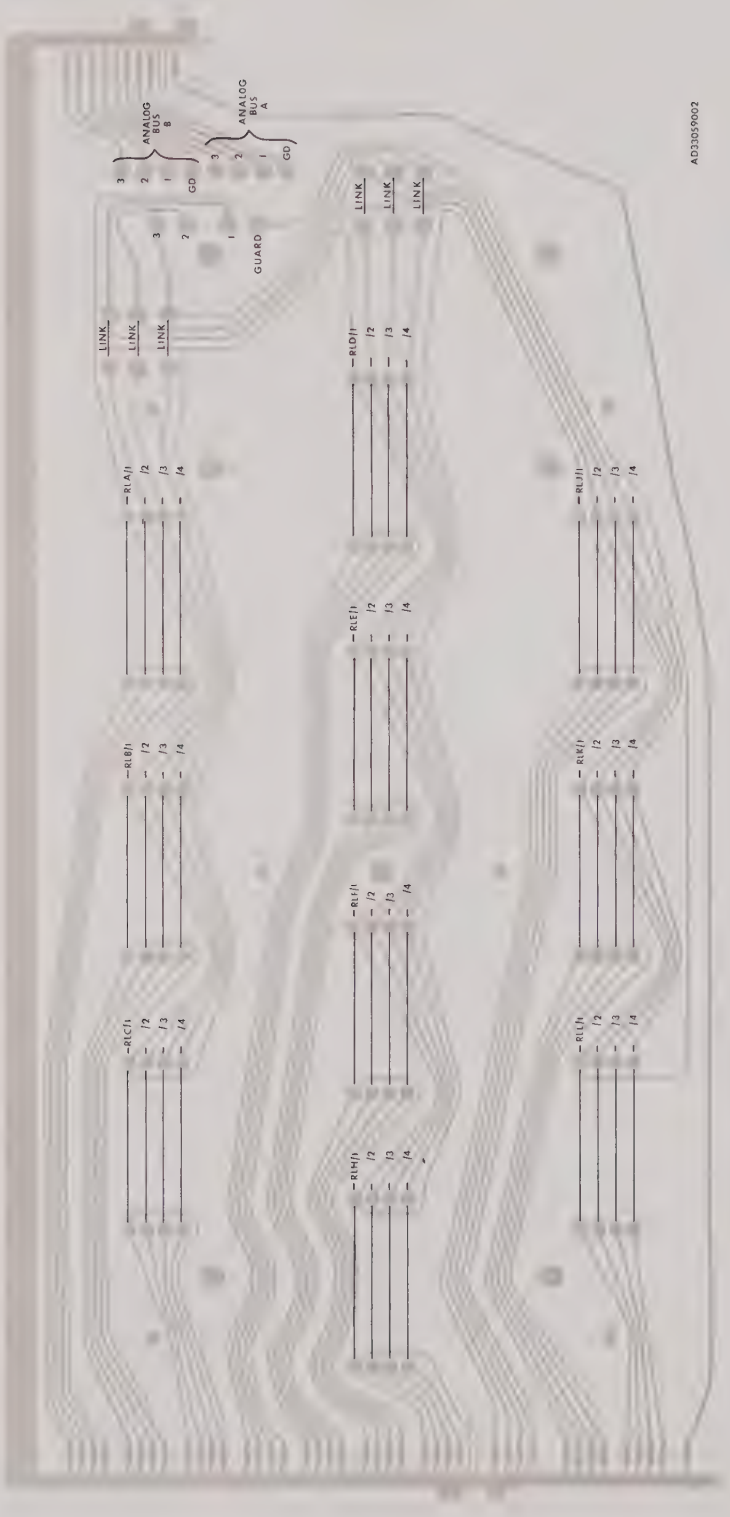
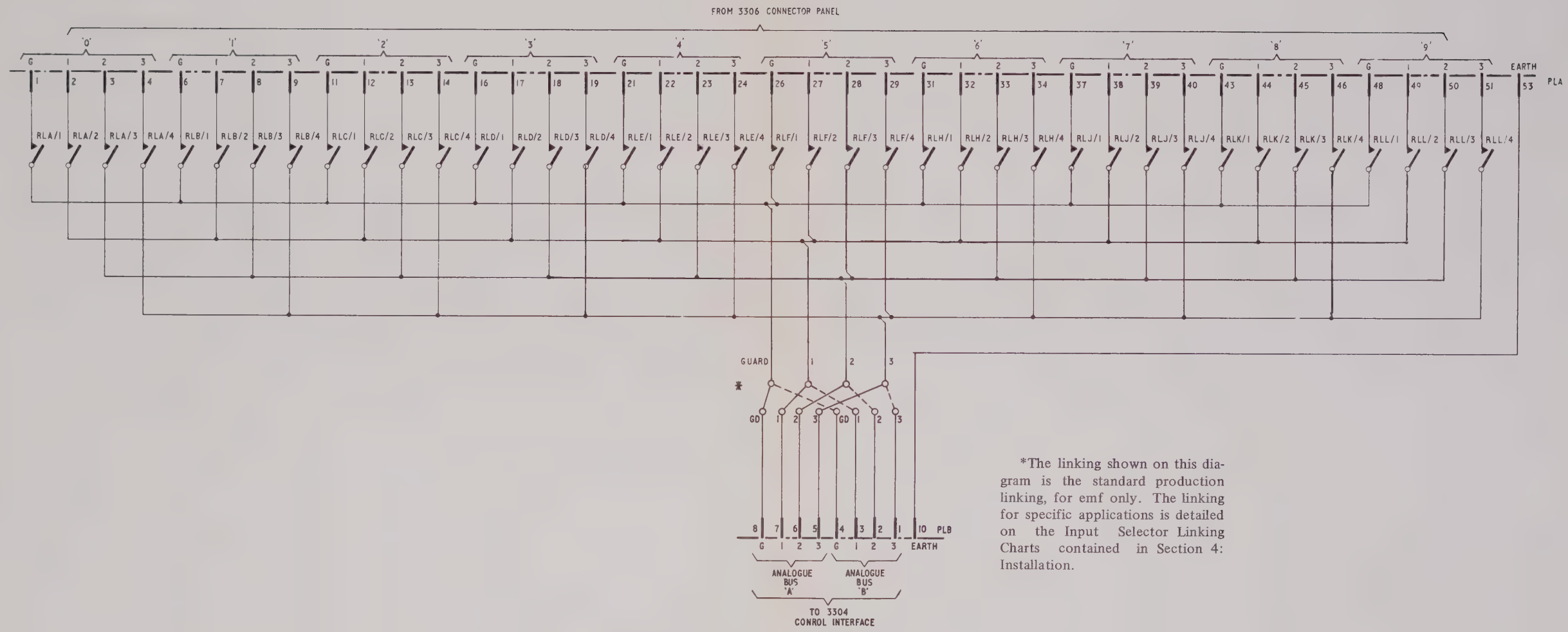
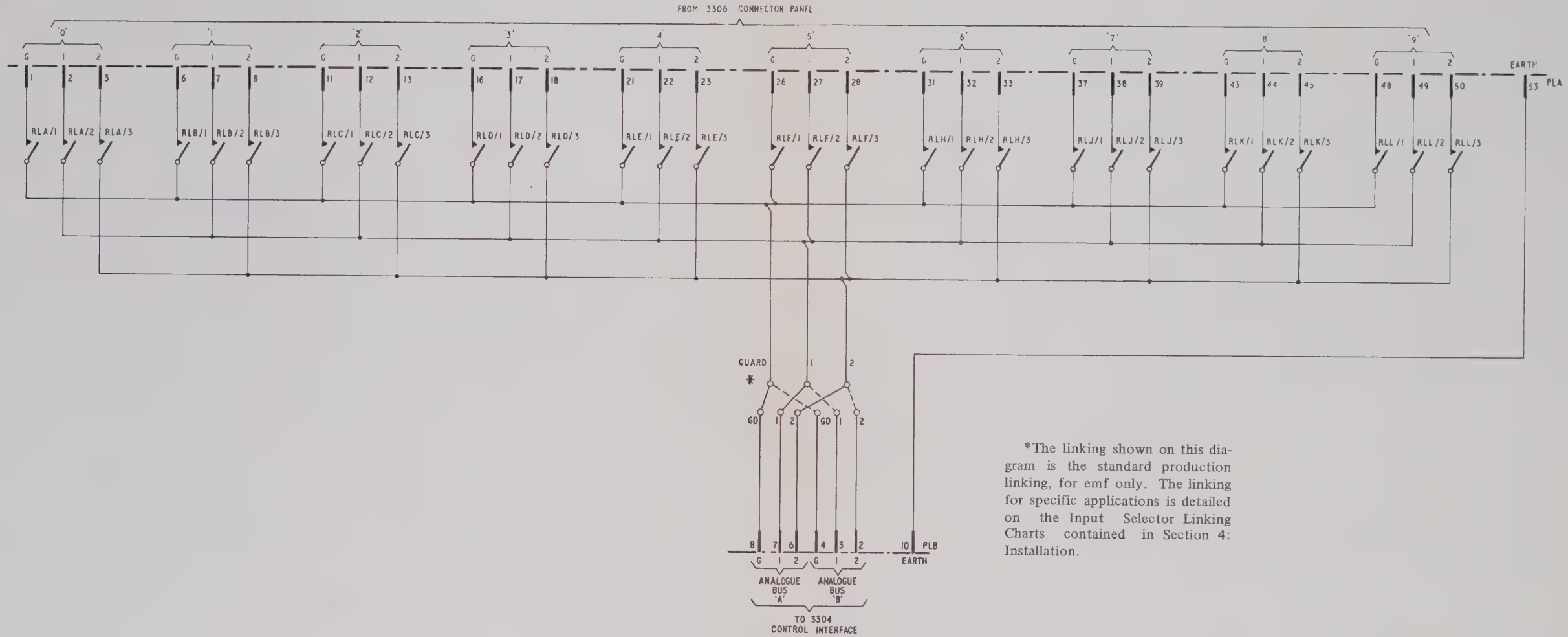


Fig. 8 Component Location ; pcb 33059002


FROM 3306 CONNECTOR PANEL
'0'
'1'
'2'
'3'
'4'
'5'
'6'
'7'
'8'
'9'
G 1 2 3
1 2 3 4 6 7 8 9 11 12 13 14 16 17 18 19 21 22 23 24 26 27 28 29 31 32 33 34 37 38 39 40 43 44 45 46 48 49 50 51 53
EARTH
PLA
RLA/1 RLA/2 RLA/3 RLA/4 RLB/1 RLB/2 RLB/3 RLB/4 RLC/1 RLC/2 RLC/3 RLC/4 RLD/1 RLD/2 RLD/3 RLD/4 RLE/1 RLE/2 RLE/3 RLE/4 RLF/1 RLF/2 RLF/3 RLF/4 RLH/1 RLH/2 RLH/3 RLH/4 RLJ/1 RLJ/2 RLJ/3 RLJ/4 RLK/1 RLK/2 RLK/3 RLK/4 RLL/1 RLL/2 RLL/3 RLL/4
GUARD
*
GD 1 2 3 GD 1 2 3
8 7 6 5 4 3 2 1 10 PLB
G 1 2 3 G 1 2 3 EARTH
ANALOGUE BUS 'A'
ANALOGUE BUS 'B'
TO 3304 CONROL INTERFACE

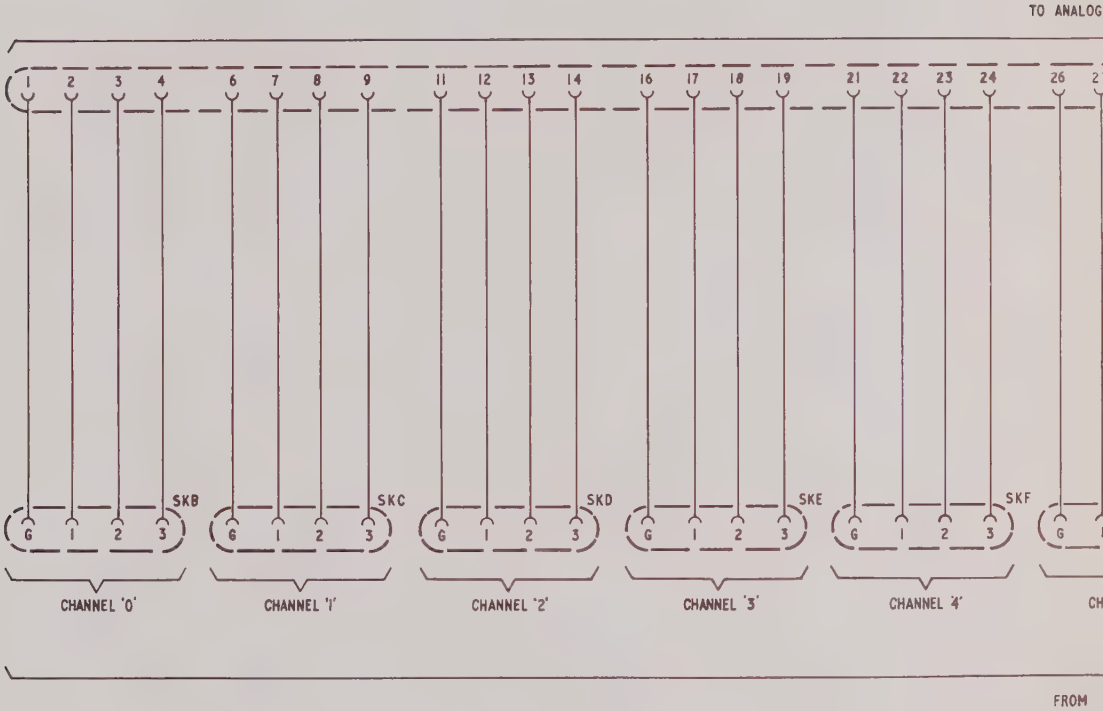
*The linking shown on this diagram is the standard production linking, for emf only. The linking for specific applications is detailed on the Input Selector Linking Charts contained in Section 4: Installation.

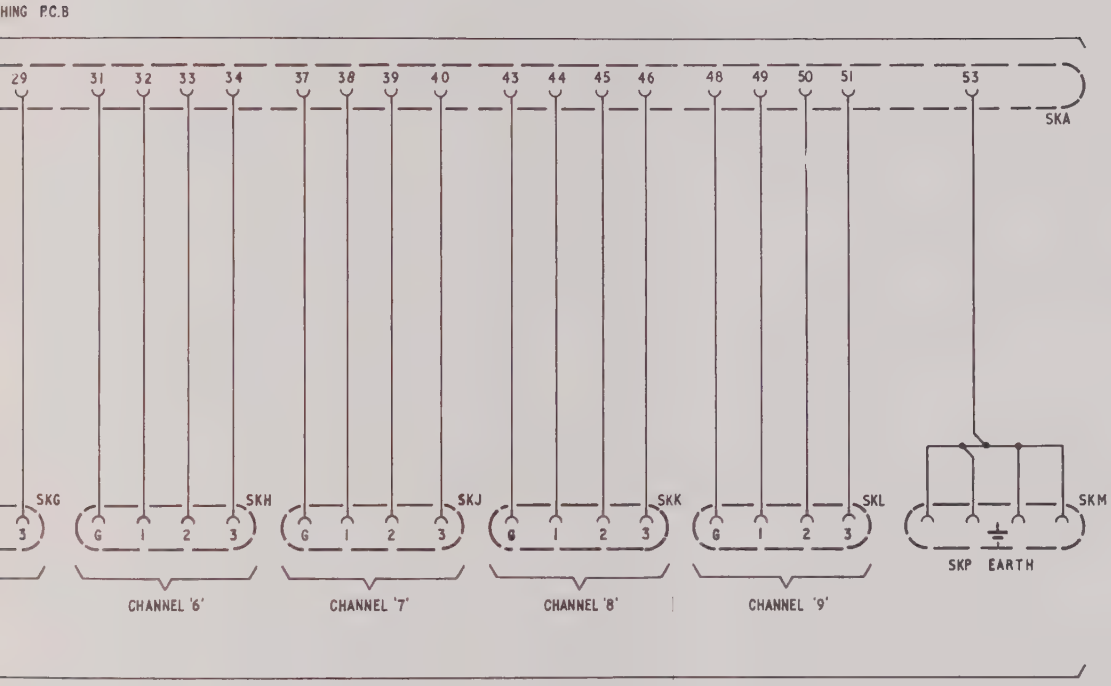
Circuit Diagram 2 : Pcb 33059002



*The linking shown on this diagram is the standard production linking, for emf only. The linking for specific applications is detailed on the Input Selector Linking Charts contained in Section 4: Installation.

Circuit Diagram 3 : Pcb 33039002


TO ANALOG
1 2 3 4 6 7 8 9 11 12 13 14 16 17 18 19 21 22 23 24 26
SKB
SKC
SKD
SKE
SKF
G 1 2 3
CHANNEL '0'
CHANNEL '1'
CHANNEL '2'
CHANNEL '3'
CHANNEL '4'
FROM



Circuit Diagram 4 : 3306 Input Connector

SECTION 5/3

Selectors 3307/3308/3309

The program selector panels provide greater flexibility in channel programming than can be obtained with internal linking on the 3304 Control Interface. All three types plug onto the input selector modules at the front of the scanner, behind the face panel - see Section 4, Fig. 5.

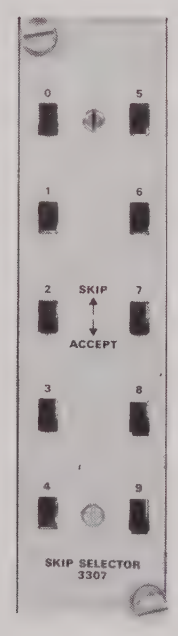


Fig. 1 ***Skip Selector Panel*** *3307*

Fig. 2 ***Program*** *Selector Panel 3308*

Skip Selector Panel 3307 (Fig. 1)

This panel enables the operator to preselect any particular channel(s) to be skipped. The term "skip" means the omission of unwanted channels in a scanning sequence. Each panel relates to one selector module and contains ten switches. Each switch relates to one of the ten channels of its associated selector module. If a switch is set to SKIP, the corresponding channel is omitted from the scan.

Program Selector Panel 3308 (Fig. 2)

The program set up on these switches applies to all of the ten channels to which the 3308 is connected. However, by means of a link change, the selected program can apply to all channels in the

scanner, irrespective of the selector module to which the 3308 is connected. This link is located on a board attached to the rear of the selector panel (Fig. 3).

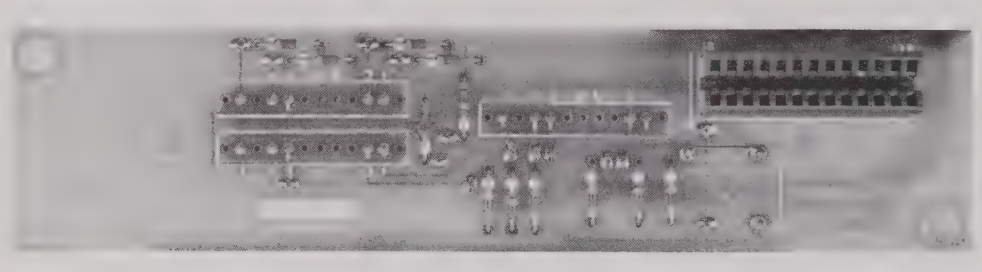


Fig. 3 Rear Board of 3308

The numbers on the upper thumbwheel switch refer to the addresses of channel programs defined in the data logger. For example, if a Compact - 33 data logger is used, the addresses are those of the programs defined on the Programmer 3335 (see Compact - 33 Operating Manual, Section 5). When the channels to which the selector is assigned are scanned, the selected logger program is called.

The lower thumbwheel switch selects the type of signal conditioning. The switch positions are as follows:

V	= Direct (Voltage) measurement – no signal conditioning, no channel skip.
C1 and C2	= Signal conditioning by thermocouple cold junction compensation, reference units 1 and 2, respectively.
C3	= Spare position.
SK	= Channel skip.

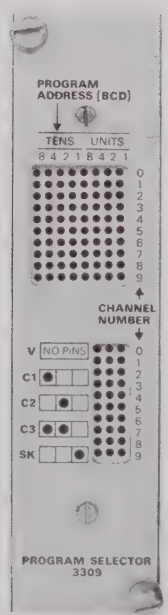


Fig. 4 Program Selector Panel 3309

Program Selector Panel 3309 (Fig. 4)

This selector is similar in principle to the 3308 but allows a unique program to be called for each of the ten channels to which it is connected. Selection is by two pinboards.

The upper pinboard calls programs defined in the data logger, as described for the 3308. It has a row of eight diode pin sockets for each of the ten channels of the associated input selector module. The program address, for each channel, is set by inserting diode pins in a pattern that represents the address in BCD form (diode inserted - logical '1'). A program address of 57 on channel 3, for example, would be set by inserting diode pins into row '3' in the following positions: 'Tens 4' and 'Tens 1'; 'Units 4', 'Units 2' and 'Units 1'. Any program address between '00' and '99' can be set up in this way.

The lower pinboard selects signal conditioning if required. It has three bits for each channel. As illustrated on the front panel, the left-hand two columns are for thermocouple cold junction compensation. The third column is for programming channel skip, i.e. the insertion of a diode pin will cause that channel to be skipped. The significance of V, C1, C2, C3 and SK are as described for the 3308.

COMPONENT PARTS LIST

ABBREVIATIONS

Circuit References

B	Battery
C	Capacitor (μF)
CSR	Thyristor
D	Diode
FS	Fuse
IC	Integrated Circuit
L	Inductor
LP	Lamp (including Neon)
LK	Link
M	Meter
MSP	Mains Selector Panel
PL	Plug
R	Resistor (Ω)
RL	Relay
S	Switch
SK	Socket
T	Transformer
TP	Terminal Post (or Test Point)
TR	Transistor
V	Valve
X	Other Components

Also Used:-

RNL	Non Linear Resistor (Ω)
RV	Variable Resistor (Ω)

Component Composition

FIXED RESISTORS

Carbon Composition	CACP
Carbon Film	CAFM
Cracked Carbon	CKCA
Metal Film	MEFM
Metal Oxide	MEOX
Power Wirewound	POWW
Precision Wirewound	PRWW
Temperature Sensitive	TEMP
Thick Film	TKFM
Thin Film	TNFM
Voltage Sensitive	VOLT

Component Composition (Cont'd)

VARIABLE RESISTORS

Wirewound Preset Single Turn	WWPS
Wirewound Preset Multiturn	WWPM
Wirewound Front Panel Single Turn	WWFS
Wirewound Front Panel Multiturn	WWFM
Carbon Preset Single Turn	CAPS
Carbon Preset Multiturn	CAPM
Carbon Front Panel Single Turn	CAFS
Carbon Front Panel Multiturn	CAFM
Cermet Preset Single Turn	CMPS
Cermet Preset Multiturn	CMPM
Cermet Front Panel Single Turn	CMFS
Cermet Front Panel Multiturn	CMFM

CAPACITORS

Air	AIR
Aluminium Electrolytic	ALME
Aluminium Solid	ALMS
Polycarbonate	CARB
Ceramic	CERM
Polyester Foil	ESTF
Polyester Metallised	ESTM
Glass	GLAS
Mica	MICA
Metallised Lacquer	MLAC
Paper Foil	PAPF
Paper Metallised	PAPM
PTFE	PTFE
Polypropylene Film	PYLN
Polystyrene	STYR
Tantalum Dry	TAND
Tantalum Foil	TANF
Tantalum Wet	TANW

Component Parts List

for

Printed Circuit Board 33079001
(Scanner Skip Selector 3307)

Cct Ref.	General Description	Solartron Part No.
SW1 to SW10	Slide Switch DPDT	375000520
	Berg P.V. Socket	352501650
	Connector	352512110

Component Parts List

for

Printed Circuit Board 33079002
(Scanner Skip Selector 3307)

Cct Ref.	General Description	Solartron Part No.
D1 to D10	SD3	300522160
SKA	Edge connector 12 way	352512110
	Polarising Key	354003791
	Berg P.V. Socket	352501650

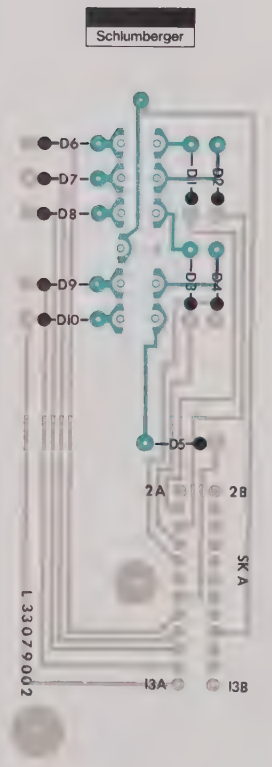


Fig. 5 Component Location; pcb 33079002

Component Parts List

for

Printed Circuit Board 33089001
(Scanner Program Selector 3308)

Cct Ref.	General Description	Solartron Part No.
D1 to D12	SD3	300522160
SKA	Connector socket	352513010
SKB to SKD	Connector Socket CU400—218	352512120
	Polarising Key	354003791

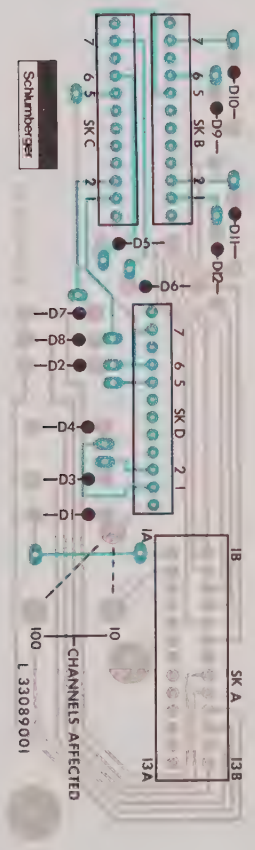


Fig. 6 Component Location; pcb 33089001

Component Parts List

for

Printed Circuit Board 3309001
(Scanner Program Selector 3309)

Cct Ref.	General Description	Solartron Part No.
SKA	Connector 13 way	352513010
	Polarising Key	354003791
D1	Diode SD3	300522160

Component Parts List

for

Printed Circuit Board 3309002
(Scanner Program Selector 3309)

Cct Ref.	General Description	Solartron Part No.
	Pinboard 10 x 3	399100340
	Pinboard 10 x 8	399100350
	Diode Pins	351301480

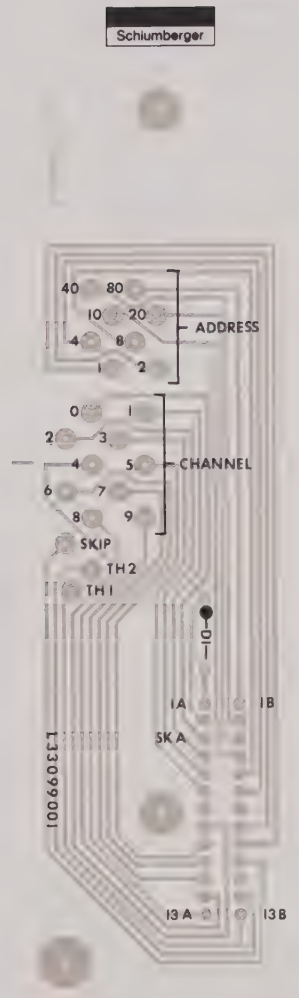
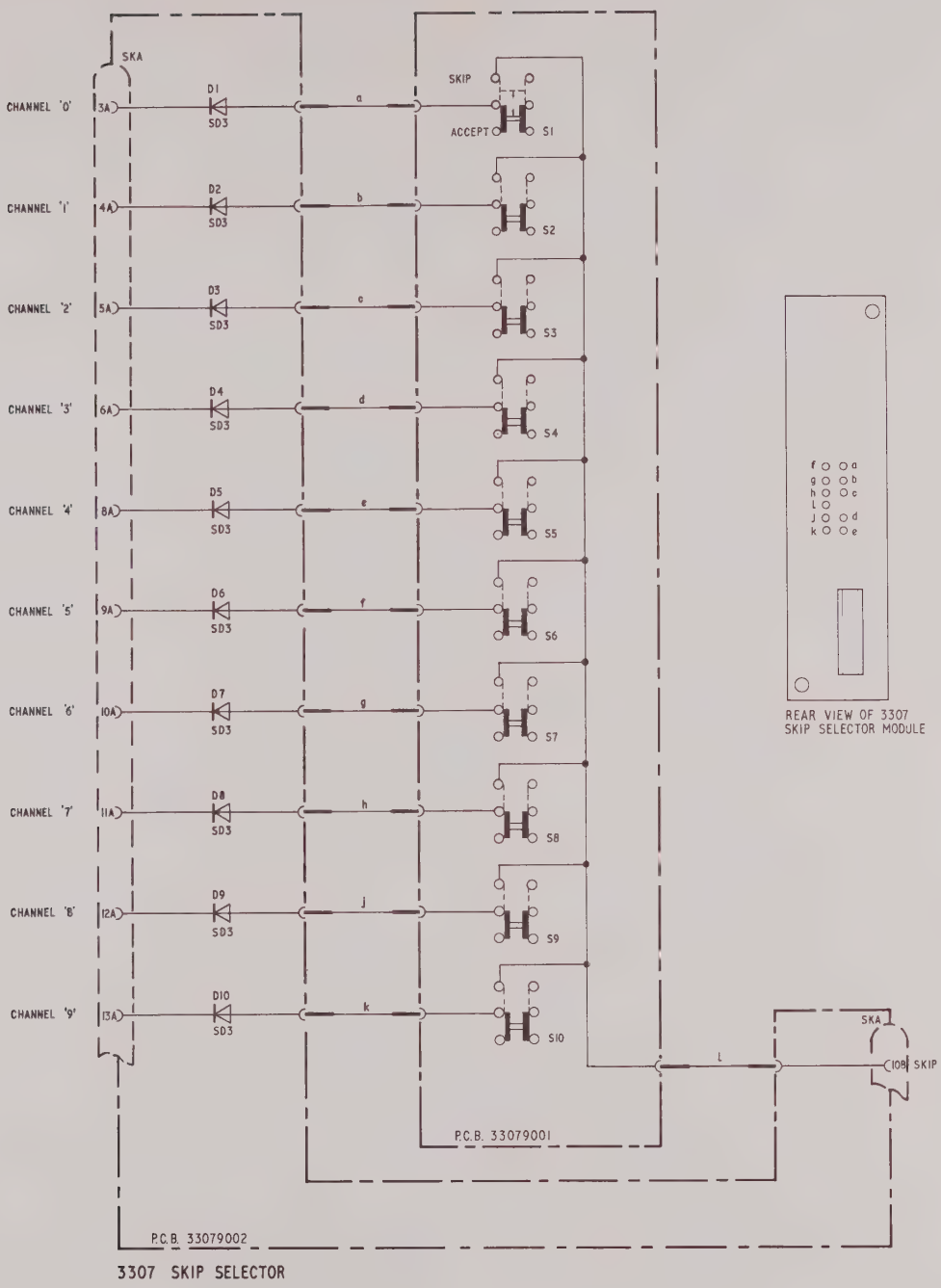
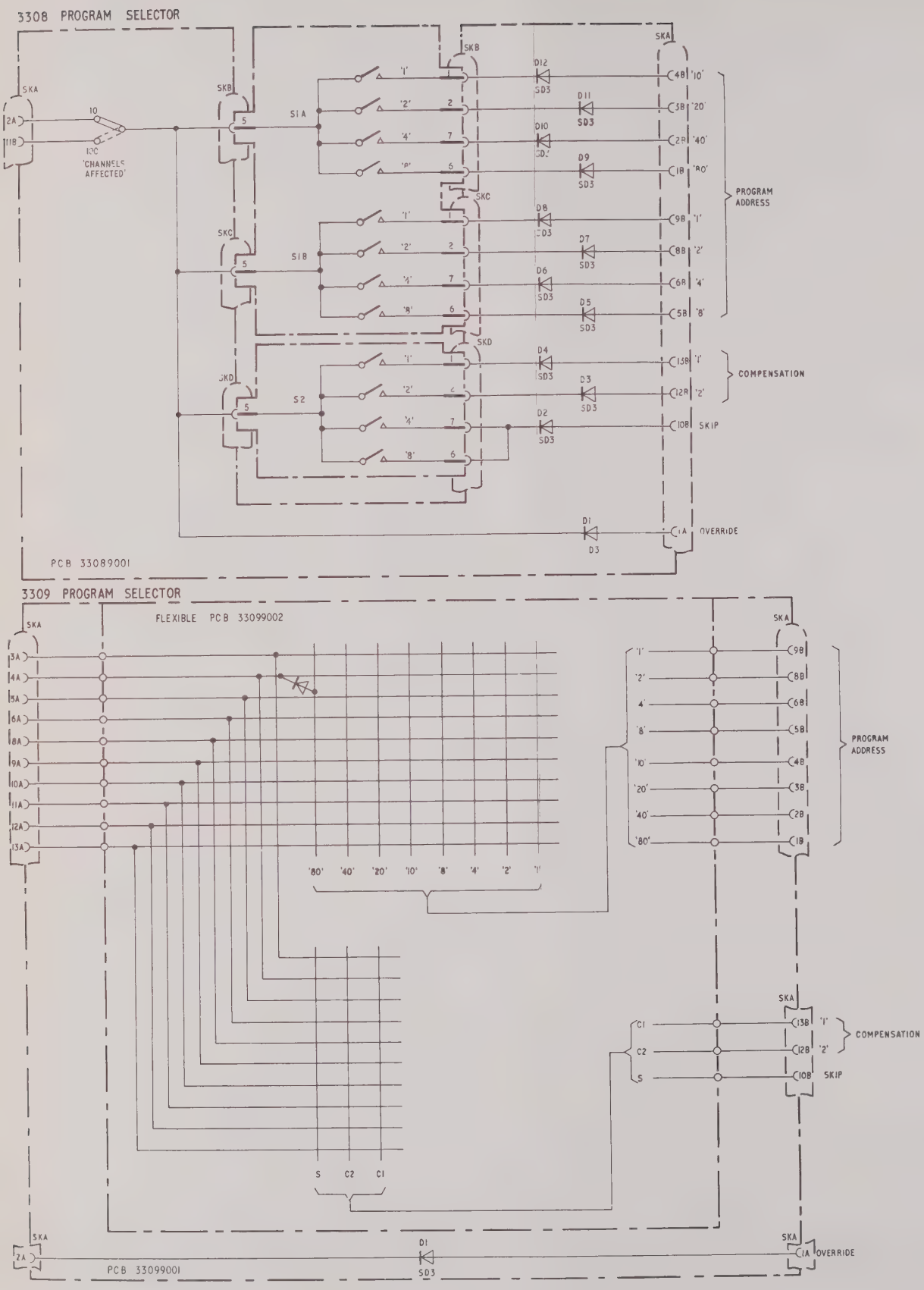


Fig. 7 Component Location; pcb 33099001



Circuit Diagram 1 : Skip and Program Selector Panels


3308 PROGRAM SELECTOR
SKA
SKB
SKC
SKD
10
10C
'CHANNELS AFFECTED'
S1A
S1B
S2
'1'
'2'
'4'
'8'
D12
D11
D10
D9
D8
D7
D6
D5
D4
D3
D2
D1
SD3
4B '10'
3B '20'
2B '40'
1B '80'
9B '1'
8B '2'
6B '4'
5B '8'
PROGRAM ADDRESS
13B '1'
12B '2'
10B SKIP
COMPENSATION
1A OVERRIDE
PCB 33089001
3309 PROGRAM SELECTOR
FLEXIBLE PCB 33099002
3A
4A
5A
6A
8A
9A
10A
11A
12A
13A
'80' '40' '20' '10' '8' '4' '2' '1'
S C2 C1
C1
C2
S
2A
PCB 33099001

SECTION 5/4 Strain Gauge Modules

STRAIN MEASUREMENT

Various methods of measuring mechanical strain are used, the most common employing a device whose electrical resistance changes when subjected to mechanical strain; these devices are called strain gauges.

A strain gauge, usually in the form of a resistance film on a thin substrate, is intimately bonded to the structure to be tested. When load is applied to the structure the strain is transmitted to the gauge, this causes a change in its resistance which is linearly proportional to the strain. The constant relating the change of resistance to strain is called the GAUGE FACTOR.

The change in resistance of the strain gauge is measured and can be scaled to give a direct reading of strain.

Various methods of measuring the resistance change could be used, but the simplest and most widely used employs a Wheatstone bridge (Fig. 1).

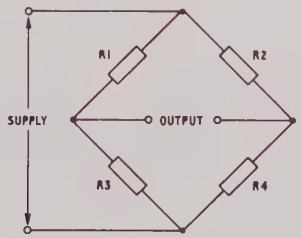


Fig. 1 Wheatstone Bridge : Basic Circuit

Typically for strain gauge measurement, three of the resistors are fixed and the fourth is the strain gauge. If the three resistors are suitably chosen, the output measured is proportional to the change of resistance of the gauge and thus the strain.

Additional circuitry may be added to the basic bridge to provide adjustments for scaling and zero balance. The operation of the bridge is basically unchanged by these additions.

Gauge Factor G

Strain = S
Initial gauge resistance = R
Change of gauge resistance due to strain S = $\triangle R$

$$G \times S = \frac{\triangle R}{R}$$

Strain Gauge Modules 3311/3312/3313/3314/3315/3316

In its strain gauge scanning form the 'Series Three' Analogue Scanner comprises a 3325 basic assembly into which are inserted sets of strain gauge modules together with 3305 input selector modules (Fig. 2).

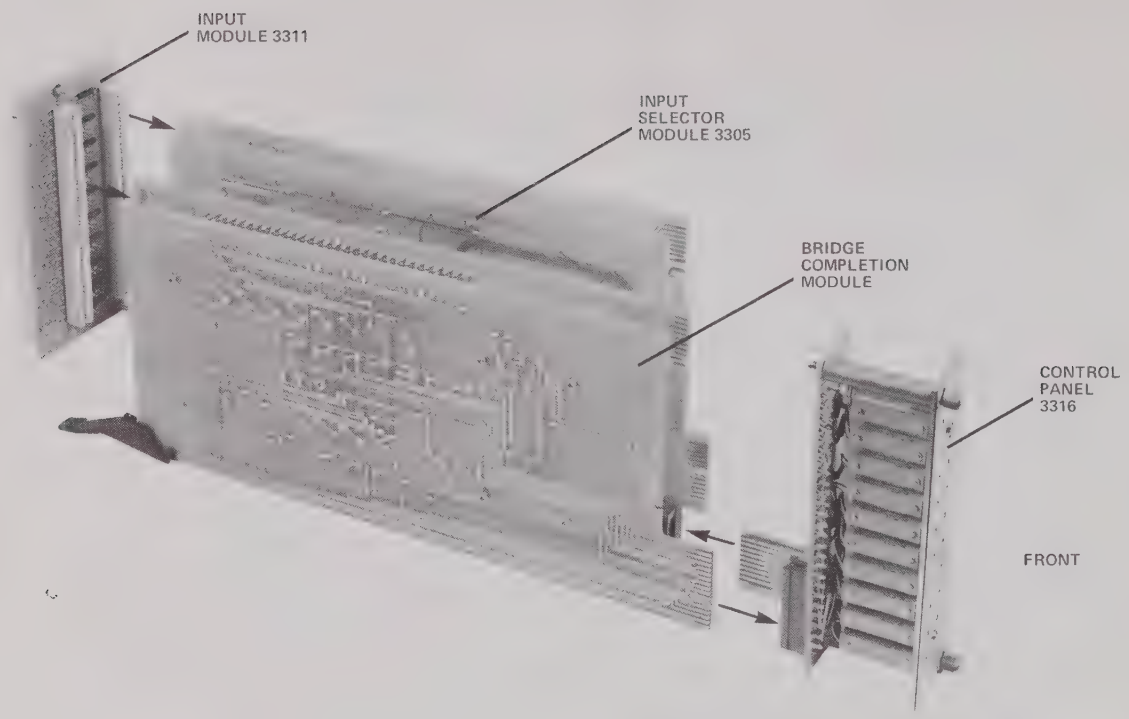


Fig. 2. A Typical Arrangement of Strain Gauge Modules

Each set of strain gauge modules provides for 10 strain gauge inputs; one 3325 assembly can provide for a maximum of 50 strain gauge inputs.

The use of strain gauge modules in the scanner does not affect its other logging functions, and use can still be made of the 3307 skip selector panel, the 3308 and 3309 program selector panels and the 3310 cold junction compensator unit.

Ten strain gauge channels occupy the same space as twenty standard input channels. Table 1 shows the number of input channels available in one 3325 assembly where a mixture of strain and normal inputs exist.

Table 1

No. of Strain Inputs required	No. of Standard Inputs	Total Number of Inputs
0	100	100
1 - 10	80	90
11 - 20	60	80
21 - 30	40	70
31 - 40	20	60
41 - 50	0	50

The selector module address links on the 3304 Digital Interface must be linked in pairs to accomodate the double module required for strain gauges. Fig. 6 on page 5/1.3 illustrates the method.

Three options of strain gauge modules are available, each option providing for full, half or quarter bridge configurations, thus making a total of 9 variations of strain gauge available.

Option A - No balance, no scale, intended for computer logger use.

Option B - Individual balance and common scale.

Option C - Individual balance and individual scale.

The sets of strain gauge modules for each option are shown in Table 2.

Table 2

Option	Input Module	Bridge Completion Module	Control Panel
A	3311	3312	-
B	3311	3313	3315*
C	3311	3314	3316

*A 3316 Control Panel may be used, in which case the 'Channel 0' scale potentiometer acts as the common scale potentiometer.

In addition a constant current supply (400μA to 30 mA) is required to energise the bridge circuit; this can be obtained from either the 3317 (single) or 3318 (double) strain gauge power units (Section 5/5).

INPUT MODULE 3311

This contains:-

(1) A group of 11 4-way connectors. Ten of these provide the terminations for the strain gauges and any external elements of the bridge, e.g. dummy gauge for ½ bridge configuration. The remaining connector provides connections for an external common dummy gauge (fixed resistor or unstrained gauge), and an earth connection.

(2) The connectors required for coupling the bridge completion module to the input selector module.

(3) Ten resistors which act as dummy gauges in the normal ¼ bridge configuration, (standard dummy gauge 120 ohms).

BRIDGE COMPLETION MODULES

Module 3312 contains 20 resistors which form the bridge completion networks for 10 strain gauge channels. The resistors are grouped in matched pairs.

Module 3313 contains the same components as the 3312 plus 40 resistors to provide a balance facility for each channel, and a relay drive circuit and resistor to provide a common scaling facility for the ten channels.

Module 3314 contains the same components as the 3312, 40 resistors to provide a balance facility for each channel and 10 resistors to provide a scaling facility for each channel.

CONTROL PANELS

The balance and scaling controls associated with options B and C are mounted on panels that plug onto the front of bridge completion modules 3313 and 3314.

Control Panel 3315 (Fig. 3) contains ten controls for balance and one for scaling.

Control Panel 3316 (Fig. 4) contains ten controls for balance and ten for scaling.

Fig. 3 Control Panel 3315

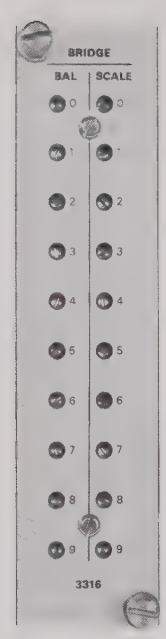


Fig. 4 Control Panel 3316

SELECTION OF OPTION AND CONFIGURATION

The scale facility is used to correct for gauges having small differences of gauge factor. It consists of a variable resistor connected across the constant current supply to each bridge circuit.

Option B provides a common scale control for the ten channels. It is used when the strain gauges for each channel of a group of ten channels are identical.

Option C provides a scale control for each channel and is used when the strain gauges are not identical.

Having chosen the option, three basic configurations are available. Table 3 lists the modules and their respective linking for the required option and configuration.

The terms 'full bridge', 'half bridge' and 'quarter bridge' refer to that part of the bridge which is external to the scanner.

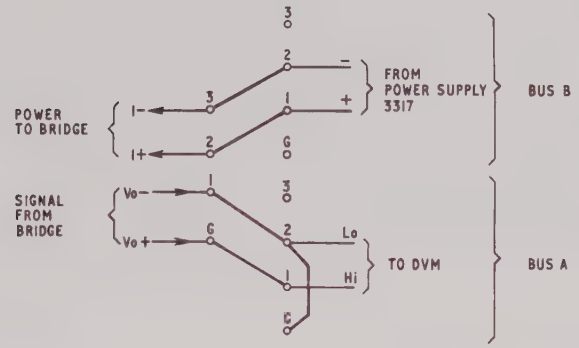
Table 3

Module Linking

		3311	3312, 3313 and 3314
Quarter bridge	2 wire 3 wire	Link pins C to A	Link pins E to D to F
Half bridge	3 wire 4 wire		
Full bridge		Link pins B to C	No links

ANALOGUE BUS LINKING (3305)

The analogue bus requirement for strain gauge measurement is two lines for the constant current supply and two lines for measurement of the bridge output. Details of the standard bus links on board 33059002 which fulfil this requirement appear in Input Selector Linking Chart 3 (Section 4 : Installation). The following diagram illustrates the function of the preferred analogue bus linking.



METHODS OF OBTAINING THE VARIOUS OPTIONS AND CONFIGURATIONS

The following examples show the variations available. Examples 1 to 6 illustrate the various bridge configurations without balance and scale, 7 and 8 cover the balance and scale options. It should be noted that 7 and 8 can be combined with any of the configurations shown in 1 to 6. Fig. 5 and 6 show the physical connections and linking required for the various configurations.

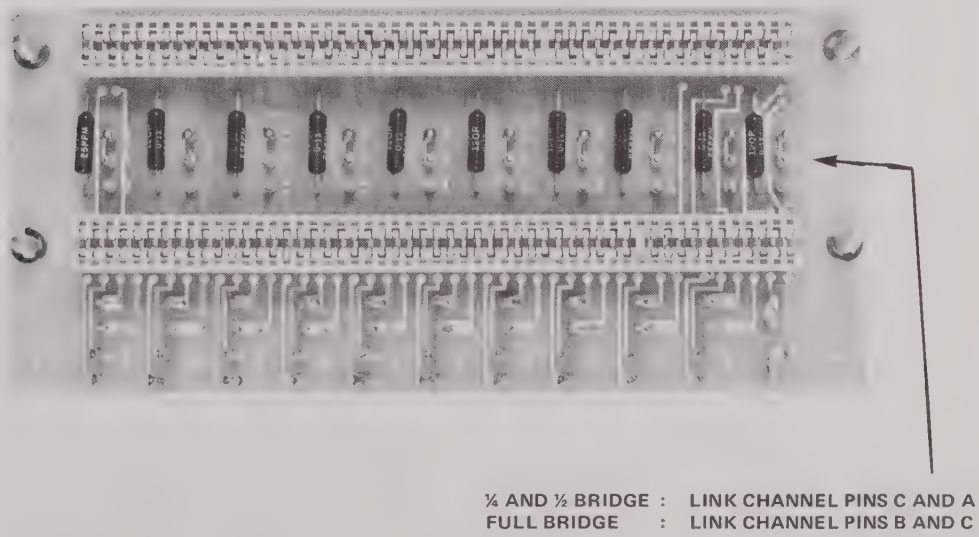
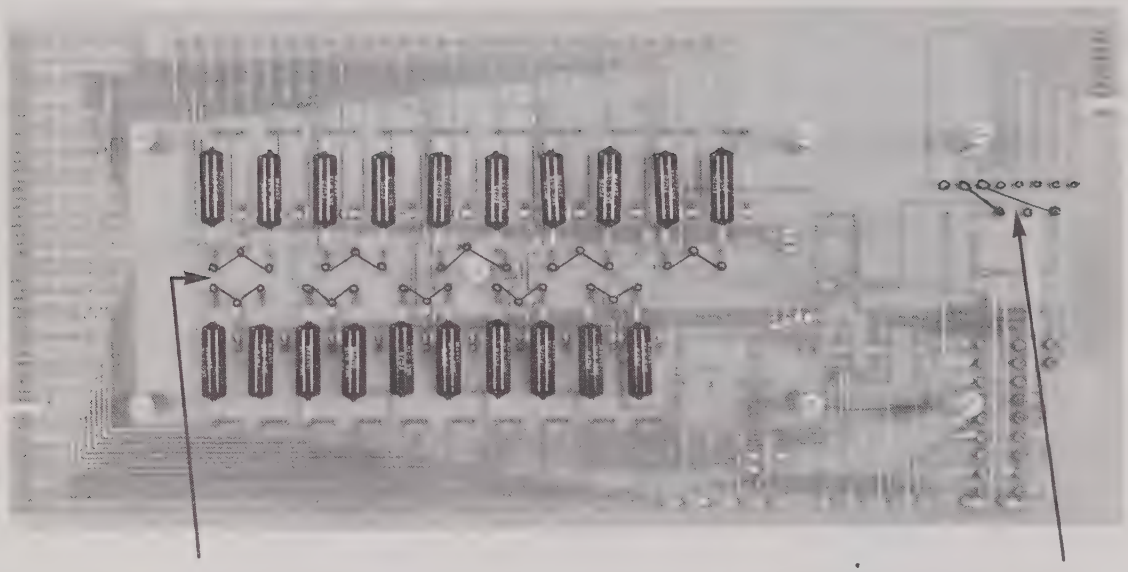


Fig. 5 Input Module 3311



MODULES 3312, 3313 AND 3314,
CHANNEL PINS E, D AND F:-

¼ AND ½ BRIDGE : LINKS AS SHOWN
FULL BRIDGE : NO LINKS

STANDARD LINKING:

LINK PINS H AND Q
LINK PINS J AND R
(THESE SHOULD NOT
REQUIRE CHANGING).

COMMON DUMMY
LINKING : M TO S

Fig. 6 Bridge Completion Module (Board 2) : Link Areas

EXAMPLE 1 (Fig. 7)

Option A - no balance - no scale - quarter bridge - two wire.

The module supplies components for three arms of the bridge, i.e. R1 and R2 on the bridge completion board and R3, the dummy strain gauge, mounted on the 3311 module. R4 is the strain gauge.

In the two-wire system an error is introduced which is due to the variability of the lead resistance in one arm of the bridge. This system can be used without serious error if only a short lead is required to connect the strain gauge, otherwise, the three-wire system is recommended - see Example 2 (Fig. 8).

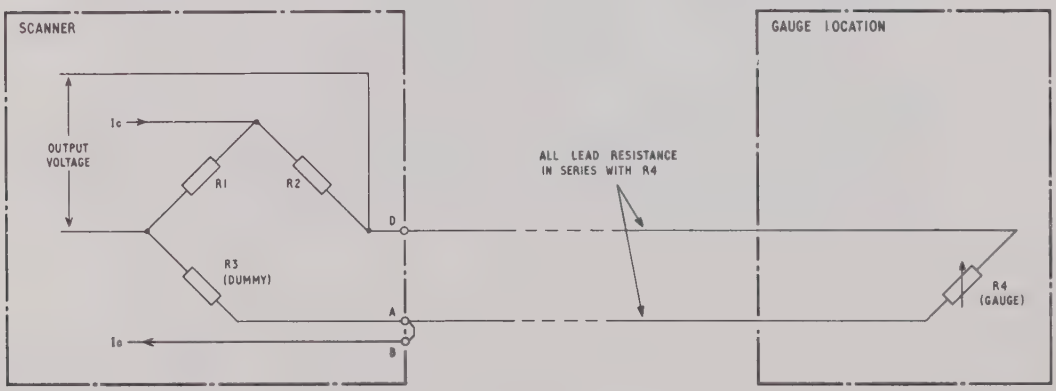


Fig. 7 Quarter Bridge, 2 Wire

EXAMPLE 2 (Fig. 8)

Option A - no balance - no scale - quarter bridge - three wire.

In the three wire system a similar long connecting wire is introduced into the opposite arm of the bridge, therefore any spurious resistance in the leads will be self cancelling. This third lead carries the bridge current and does not affect the measurement.

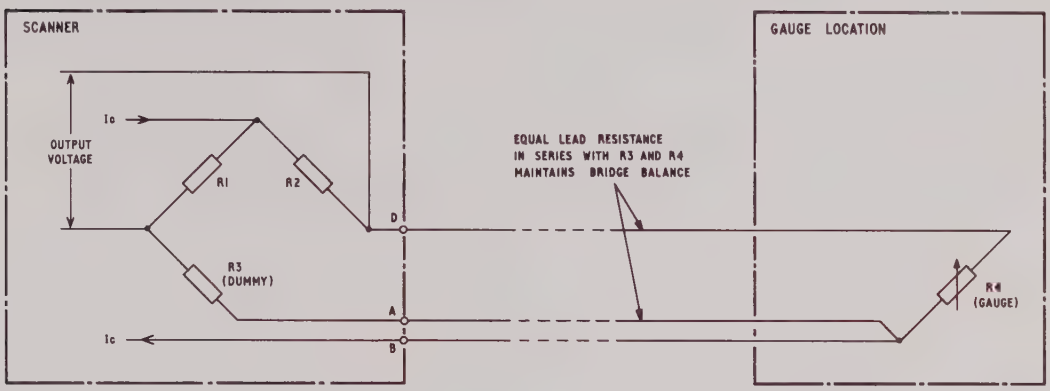


Fig. 8 Quarter Bridge, 3 Wire

EXAMPLE 3 (Fig. 9)

Option A - no balance - no scale - quarter bridge - common dummy.

The modules supply components for two arms of the bridge, i.e. R1 and R2, on the bridge completion board. The common dummy resistor is external to the modules and may be mounted in a location best suited to the user. The gauge should be connected as for standard quarter bridge use. One or more groups of bridges may be connected for common dummy operation in a system while other bridges are connected as standard half or quarter bridge networks.

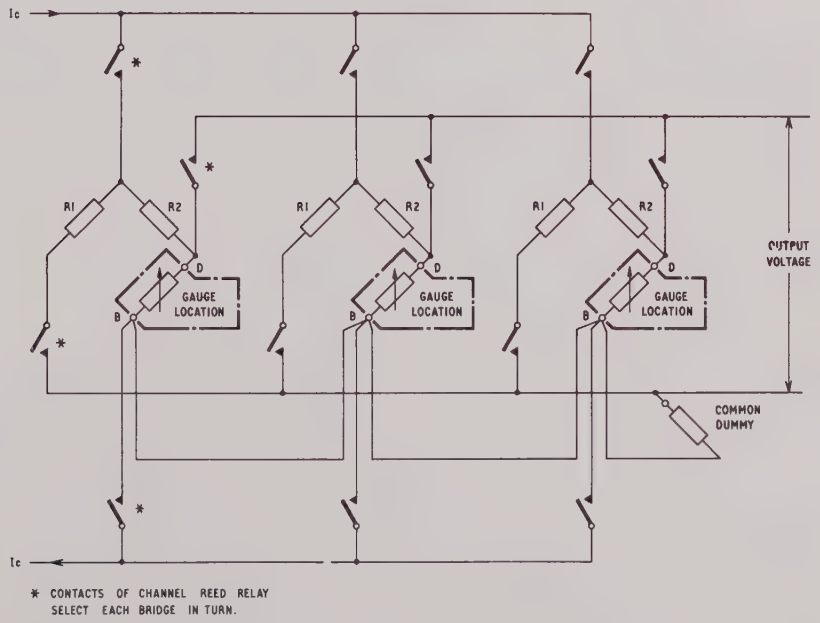


Fig. 9 Quarter Bridge, Common Dummy

Common dummy operation introduces two disadvantages as follows:

(1) Compensation for differing leads to gauges is more difficult.

(2) A relay contact is introduced into the active bridge circuit.

The effects of the relay contact is minimised by the best choice of its position in the circuit and the quality of relays chosen. However, common dummy operation of this type is not generally recommended.

EXAMPLE 4 (Fig. 10)

Option A - no balance - no scale - half bridge - three wire.

Resistors R1 and R2 are located on the bridge completion module. Dummy gauge R3 is fitted adjacent to R4 thereby avoiding errors due to the temperature difference of R3. R4 and their leads.

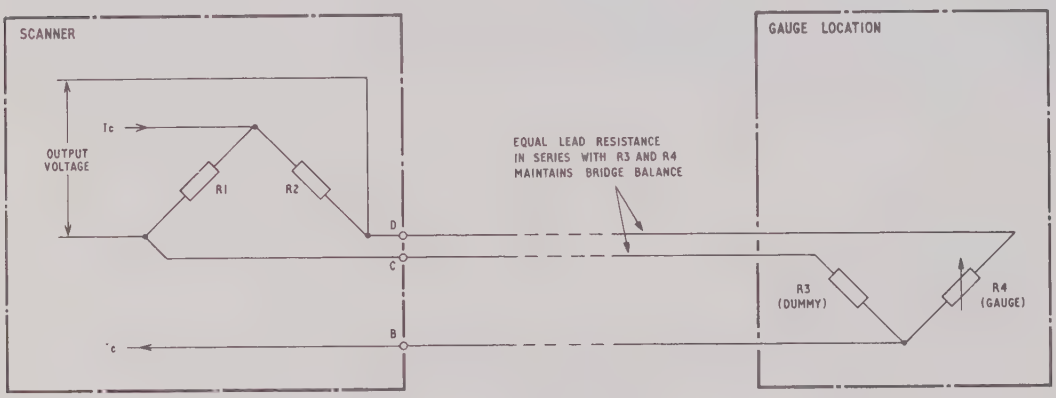


Fig. 10 Half Bridge, 3 Wire

EXAMPLE 5 (Fig. 11)

Option A - no balance - no scale - half bridge - four wire.

This configuration is used when, for practical reasons, it is required to run four leads to the remote dummy gauge and gauge, e.g. when gauge and dummy are in different locations.

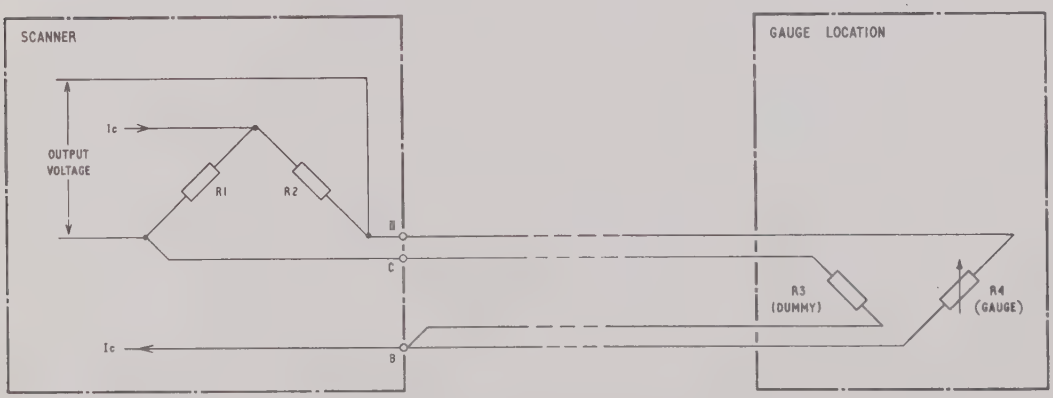


Fig. 11 Half Bridge, 4 Wire

EXAMPLE 6 (Fig. 12)

Option A - no balance - no scale - full bridge configuration.

All components of the bridge are external from the modules.

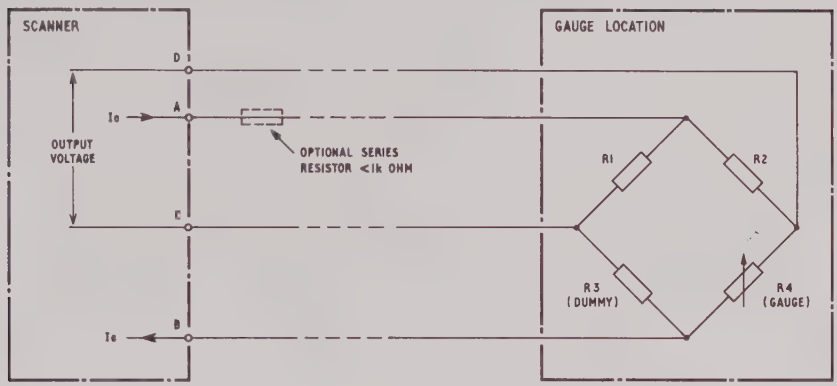


Fig. 12 Full Bridge

EXAMPLE 7 (Fig. 13 and 14)

Option B - individual balance - common scale.

Can be used in all configurations. The balance potentiometer allows the bridge circuit to be balanced for zero output or other offsets for a given strain gauge resistance. By use of the shorting links (Fig. 15) two ranges of balance can be obtained:

± 0.3% - no links
± 2% - links connected

The scale potentiometer is connected across the supply of each of the ten channels as they are selected. It provides a sensitivity adjustment of approx. 20%. See note.

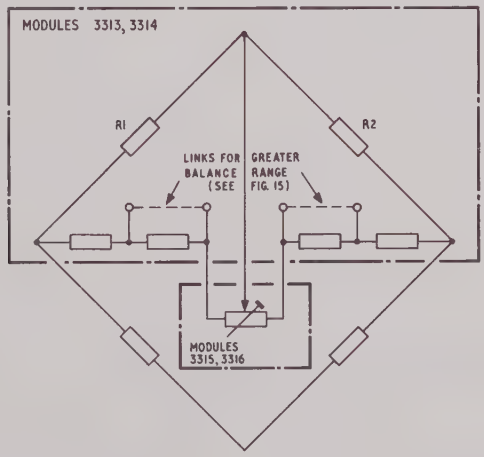


Fig. 13 Organisation of Balance Control

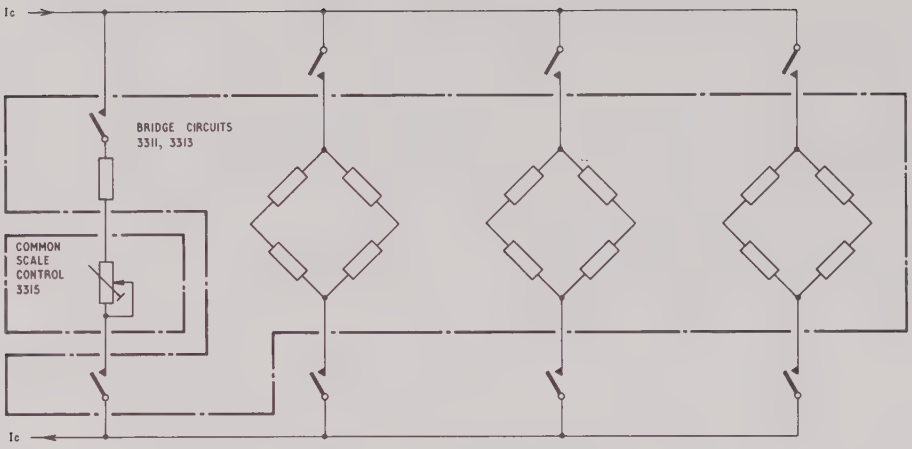


Fig. 14 Common Scale Control

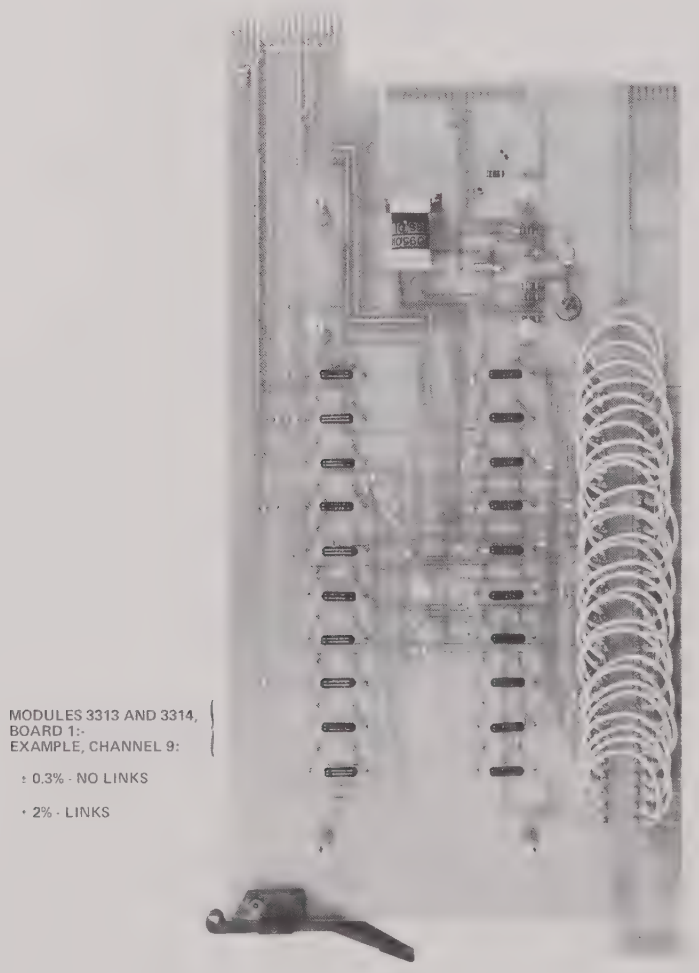


Fig. 15 Balance Range Links

EXAMPLE 8 (Fig. 13, 15 and 16)

Option C - individual balance - individual scale.

Can be used in all configurations. Each scale potentiometer is connected across the associated bridge to provide sensitivity adjustment of approx. 20%. See note.

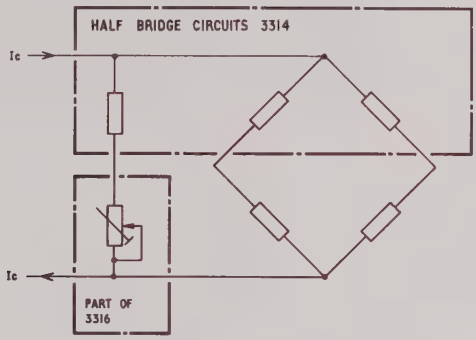


Fig. 16 Per Channel Scale Control

NOTE: Full Bridge Balance and Scale Control

The values of resistors used in remote full bridge are not defined. Consequently the range of balance and scale controls is undefined.

If the range of balance and/or scale control is insufficient, a resistor not exceeding 1000 ohms can be added in series with the positive supply lead to each full bridge. This will increase the range of control available without degrading the performance of the system.

DIGITAL CONTROL INTERFACE AND SELECTOR MODULE LINKING

Ensure that the Digital Control Interface and the Selector Modules are linked correctly. The linking depends upon the total number of inputs to the scanner, and reference should be made to Sections 5/1 and 5/2 of this Manual.

STRAIN GAUGE CALIBRATION

To calibrate a strain gauge bridge, a known change must be made, perferably a known change in gauge resistance. A convenient method of effecting this change is provided by the 3373 Calibration Switch. This switch is located behind the front panel of the strain gauge scanner. Its three positions are as follows:-

'INT CAL 10000μ STRAIN' - In this position, an internal 5.88k ohms resistor is connected across the dummy arm of the bridge, thus simulating a strain of 10,000μ strain. This assumes a gauge resistance of 120 ohms and a gauge factor of 2. For gauges having a different resistance or gauge factor, a different strain will be simulated. The value of this can be calculated from the formula:-

$$S = \frac{10^6 \times Rg}{G\,(Rg + 5880)}$$

where, S is the simulated strain in μ strain,
G is the gauge factor, and
Rg is the gauge resistance in ohms.

If a calibration value of 10,000μ strain is required for gauges other than those having a resistance of 120 ohms and a gauge factor of 2, the 'EXT CAL' position can be used.

'MEASURE' - This position is used for normal bridge measurements; no resistor is connected across the dummy arm.

'EXT CAL' - In this position, an external calibration resistor can be connected across the dummy arm, via the pair of terminals also mounted on the 3373 Calibration Switch panel. The value of the external calibration resistor, R cal, is calculated from the formula:-

$$R\ cal = Rg\left(\frac{10^6}{G \times S} - 1\right)$$

where, Rg is the gauge resistance in ohms
G is the gauge factor, and
S is the desired calibration value in μ strain.

Calibration Procedure

The calibration procedure, using the 3373 Calibration Switch, depends on the balance and scale option used. For each option, the calibration procedure appears under the appropriate heading.

Note: The DVM should be set for a resolution of 1μV.

PROCEDURE a) For systems not equipped with balance or scale potentiometers (Option A).

1. Select any one of the strain gauge channels, e.g. channel '00.
2. Adjust the strain gauge power supply until the system DVM shows a difference of '10000' when the 3373 is switched between 'calibrate' and 'measure'.
3. Switch to 'measure'.
4. Perform one complete scan of all channels to be calibrated, and record zero load values.
5. Switch to 'calibrate'.
6. Perform another complete scan and record the calibration value for each channel.
7. Switch to 'measure'. The system is now ready for use.

PROCEDURE b) For systems equipped with individual balance potentiometers, and a common scale potentiometer for each block of ten channels (Option B; 3315 Control Panel).

1. Set the strain gauge power supply to approximately 10mA.
2. Set the 3373 Calibration Switch to 'measure'.
3. Select each channel to be calibrated, in turn, and adjust the associated 3315 balance' potentiometer to give a DVM reading of zero.
4. Switch to 'calibrate'.
5. Select the first channel of the first block of ten on which calibration is being carried out.
6. Set the common 'scale' potentiometer on the associated 3315 Control Panel to its mid position.
7. Adjust the strain gauge power supply until the system DVM reads '10000'.
8. Select each of the other nine channels in the block in turn, checking for a DVM reading of '10000' in each case. Any deviations can be recorded if desired.
9. If further channel blocks are to be calibrated, leave the calibration switch on 'calibrate', and select the first channel of the next block of ten.
10. Adjust the 'scale' potentiometer on the associated 3315 Control Panel until the DVM reads '10000'.
11. Select each of the other nine channels in the block in turn, checking for a DVM reading of '10000' in each case. Any deviations can be recorded if desired.
12. Repeat operation 9. 10 and 11 until all blocks of channels are calibrated.
13. Set the calibration switch to 'measure'. The system is now ready for use.

PROCEDURE c) For systems equipped with individual balance potentiometers and individual scale potentiometers. (Option C; 3316 Control Panel).

1. Set the strain gauge power supply to approximately 10mA.
2. Set the 3373 Calibration Switch to 'measure'.
3. Select each channel to be calibrated, in turn, adjusting the associated 3316 'balance' potentiometer for a DVM reading of zero.
4. Switch to 'calibrate'.
5. Select the first of the channels on which calibration is being carried out.
6. Set the associated 3316 'scale' potentiometer to its mid position.
7. Adjust the strain gauge power supply for a DVM reading of '10000'.
8. With the calibration switch at 'calibrate', and without making any further adjustment to the power supply, select each remaining channel in turn, adjusting the associated 'scale' potentiometer for a DVM reading of '10000'.
9. Switch to 'measure'. The system is now ready for use.

Note:- The range of 'scale' control is limited, and when strain gauges with widely different parameters are used in the same system it is sometimes necessary to allocate a separate power supply to each type of gauge. In this case, when calibrating the strain gauges, adjustment must be made to the appropriate power supply.

COMPONENT PARTS LIST

ABBREVIATIONS

Circuit References

B	Battery
C	Capacitor (μF)
CSR	Thyristor
D	Diode
FS	Fuse
IC	Integrated Circuit
L	Inductor
LP	Lamp (including Neon)
LK	Link
M	Meter
MSP	Mains Selector Panel
PL	Plug
R	Resistor (Ω)
RL	Relay
S	Switch
SK	Socket
T	Transformer
TP	Terminal Post (or Test Point)
TR	Transistor
V	Valve
X	Other Components

Also Used:-

RNL	Non Linear Resistor (Ω)
RV	Variable Resistor (Ω)

Component Composition

FIXED RESISTORS

Carbon Composition	CACP
Carbon Film	CAFM
Cracked Carbon	CKCA
Metal Film	MEFM
Metal Oxide	MEOX
Power Wirewound	POWW
Precision Wirewound	PRWW
Temperature Sensitive	TEMP
Thick Film	TKFM
Thin Film	TNFM
Voltage Sensitive	VOLT

Component Composition (Cont'd)

VARIABLE RESISTORS

Wirewound Preset Single Turn	WWPS
Wirewound Preset Multiturn	WWPM
Wirewound Front Panel Single Turn	WWFS
Wirewound Front Panel Multiturn	WWFM
Carbon Preset Single Turn	CAPS
Carbon Preset Multiturn	CAPM
Carbon Front Panel Single Turn	CAFS
Carbon Front Panel Multiturn	CAFM
Cermet Preset Single Turn	CMPS
Cermet Preset Multiturn	CMPM
Cermet Front Panel Single Turn	CMFS
Cermet Front Panel Multiturn	CMFM

CAPACITORS

Air	AIR
Aluminium Electrolytic	ALME
Aluminium Solid	ALMS
Polycarbonate	CARB
Ceramic	CERM
Polyester Foil	ESTF
Polyester Metallised	ESTM
Glass	GLAS
Mica	MICA
Metallised Lacquer	MLAC
Paper Foil	PAPF
Paper Metallised	PAPM
PTFE	PTFE
Polypropylene Film	PYLN
Polystyrene	STYR
Tantalum Dry	TAND
Tantalum Foil	TANF
Tantalum Wet	TANW

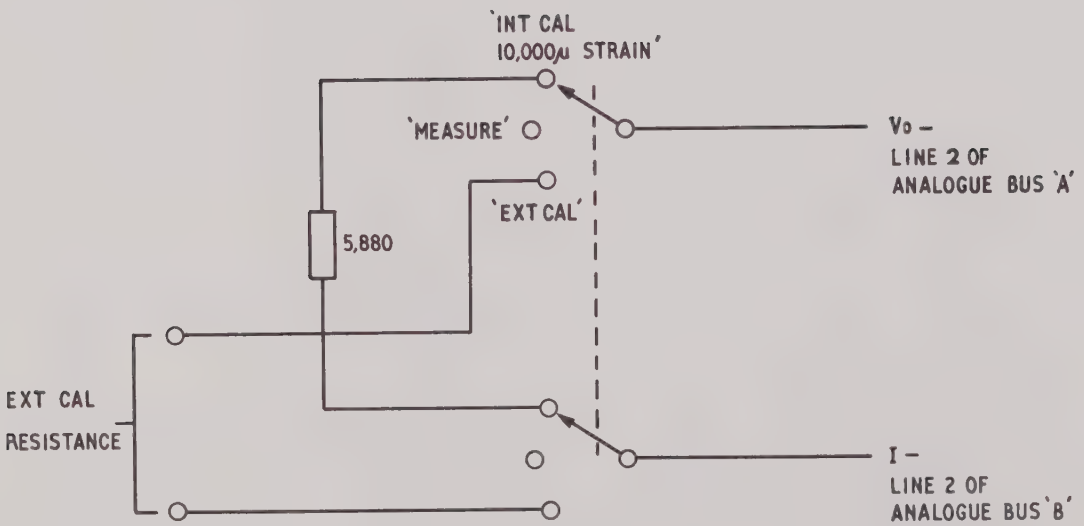


Fig. 17 Strain Gauge Calibration Switch 3373

CIRCUIT DESCRIPTION

Each of the strain gauge configurations listed in table 3 provides for the inclusion of a strain gauge in a Wheatstone bridge. A circuit diagram of each configuration is given, relating to channel '0'; details of the bridges relating to channels 1 - 9 appear on the diagrams in tabular form.

Table 3

OPTION	Type of Strain Gauge	Balance and Scale Function	Modules Used
A . 1	Quarter bridge	No balance, No scale	3305, 3311, 3312
. 2	Half bridge		
. 3	Full bridge		3305
B . 1	Quarter bridge	Individual balance, Common scale	3305, 3311, 3313, 3315
. 2	Half bridge		
. 3	Full bridge		
C . 1	Quarter bridge	Individual balance, Individual scale	3305, 3311, 3314, 3316
. 2	Half bridge		
. 3	Full bridge		

OPTION 'A'

Option 'A' has neither a balance nor a scaling facility and is intended for applications where zero setting and scaling can be taken into account subsequent to the strain measurement, e.g., by a computer. No circuit is given for the full bridge configuration since this involves the use of a 3305 Input Selector only.

OPTIONS 'B' AND 'C'

In options 'B' and 'C' each bridge circuit has an individual 'balance' potentiometer connected permanently across it, and in this respect both options are the same. The way in which they differ is in the method of connecting the 'scale' potentiometer across the constant current bridge supply. In option 'C' each bridge has an individual scale potentiometer connected across it which is brought into effect when that particular bridge is called. In option 'B', however, a common 'scale' potentiometer is connected across the constant current bus lines to the associated 3305 Input Selector while that module is responding to its particular group of channel addresses. In the latter case the scale potentiometer appears across each of the ten bridges in succession, as they are called.

The common scale potentiometer of option 'B' is connected across the constant current bus lines through relay RLA on pcb 33139001; the associated relay driver circuit TR1, TR2, is switched on only when the 'hundreds detail' and 'tens drive' inputs are in the 'called' state, Lo and Hi respectively.

Component Parts List

for

Printed Circuit Board 33119001
(Quarter Bridge Input Module 3311)

Cct Ref.	General Description	Solartron Part No.
R1 to R10	MEFM 120 1/4W 0.1%	198121204
SKA	53 way edge connector	352553030
SKB to SKM	4 way connector block	355604060
SKN	53 way edge connector	352553010

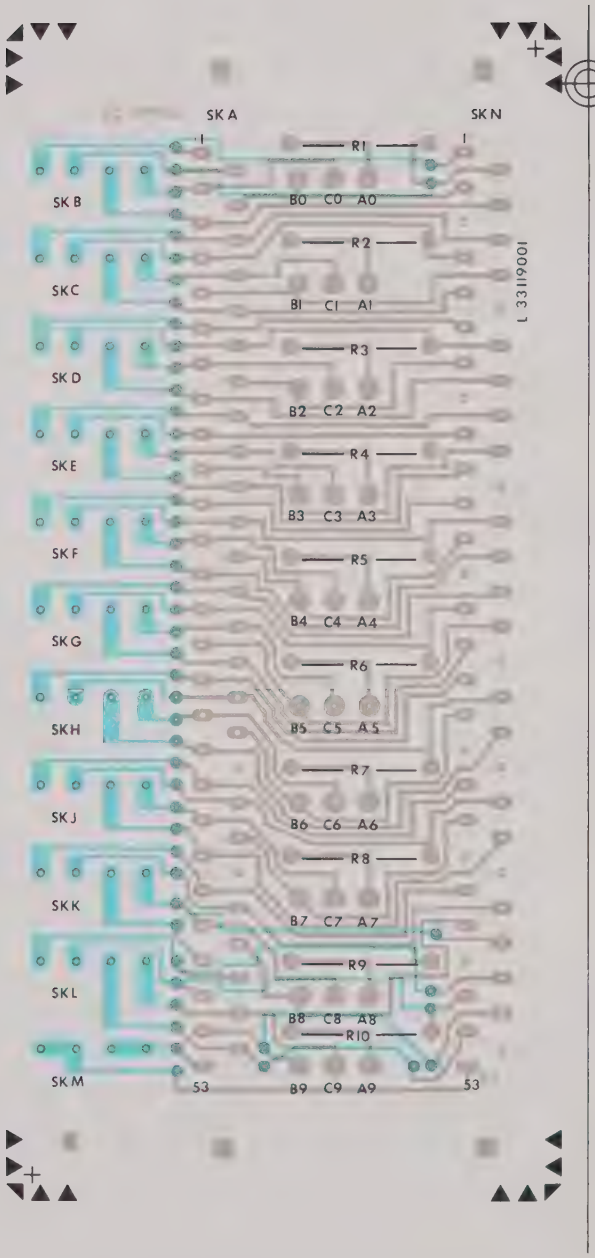


Fig. 18 Component Location; pcb 33119001

Component Parts List

for

Printed Circuit Board 33129001
(Half Bridge Completion Module 3312)

Cct Ref.	General Description				Solartron Part No.
R1 to R20	CACP	1.5k	1/2W	0.1%	160300408

Component Parts List

for

Printed Circuit Board 33139001
(Half Bridge Completion Module 3313)

Cct Ref.	General Description				Solartron Part No.
R1	CACP	8.2k	1/8W	10%	172038200
R2	CACP	18k	1/8W	10%	172041800
R3	CACP	1.8k	1/8W	10%	172031800
R4	CACP	4.7k	1/8W	10%	172034700
R5	CACP	270	1/8W	10%	172022700
R6 to R25	MEFM	27k	1/4W	0.5%	198242701
R26	CACP	1.8k	1/8W	10%	172031800
C1	TAND	4.7	10V	20%	265464700
C2	CERM	0.047	25V	+50% −25%	241944700
TR1	BC107				300553320
TR2	MM1614				300551670
	Transistor Pad (For use with TR1)				300584030
	Transistor Pad (For use with TR2)				300584090
RLA	Relay Drive Coil				309501101

Component Parts List

for

Printed Circuit Board 33149001
(Half Bridge Completion Module)

Cct Ref.	General Description				Solartron Part No.
R6 to R25	MEFM	27k	1/4W	0.5%	198242701

Component Parts List

for

Printed Circuit Board 33139002
(Half Bridge Completion Module 3313)

Cct Ref.	General Description				Solartron Part No.
R1 to R20	CACP	1.5k	1/2W	0.1%	160300408
R21 to R40	MEFM	15k	1/4W	0.5%	198241504
R51	MEFM	1.5k	1W	1%	198731502
RLA	Reed Relay Insert				379602703
SKC	12 Way Socket				352512070

Component Parts List

for

Printed Circuit Board 33149002
(Half Bridge Completion Module 3314)

Cct Ref.	General Description				Solartron Part No.
R1 to R20	CACP	1.5k	1/2W	0.1%	160300408
R21 to R40	MEFM	15k	1/4W	0.5%	198241504
R41 to R50	MEFM	1.5k	1W	1%	198731502
SKC	12 way socket				352512070

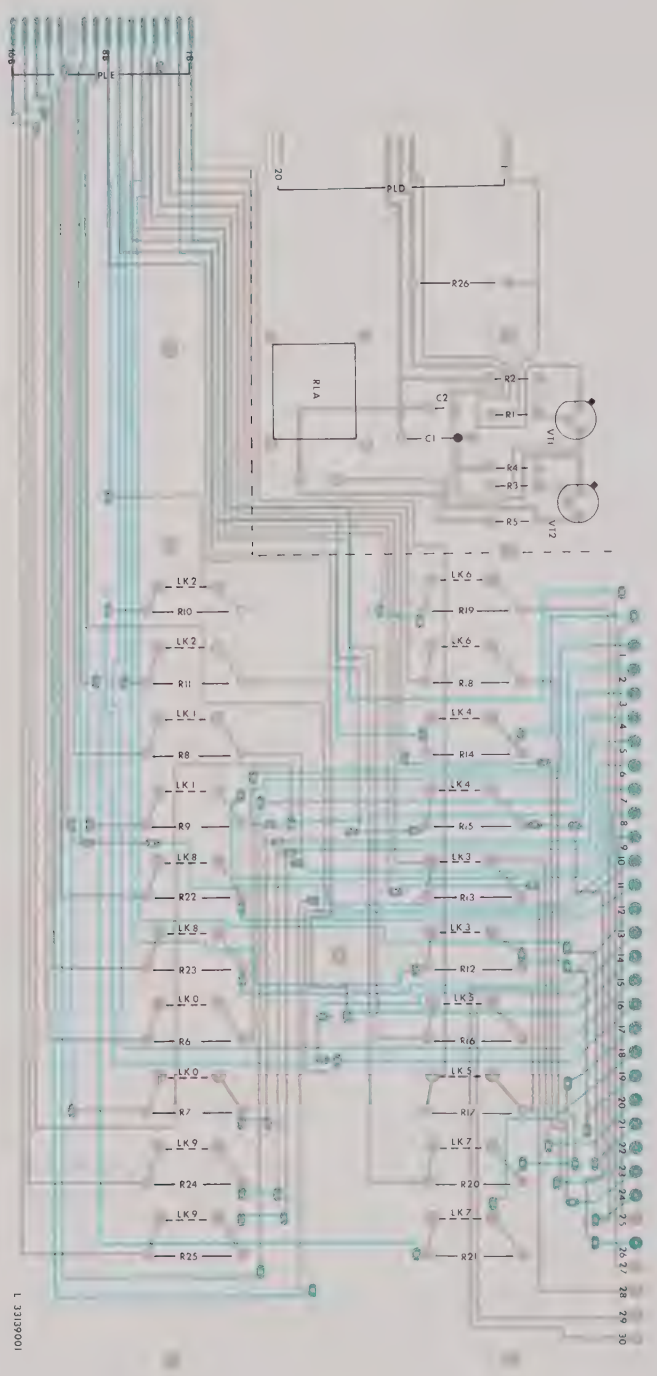


Fig. 19 Component Location; pcb 33139001

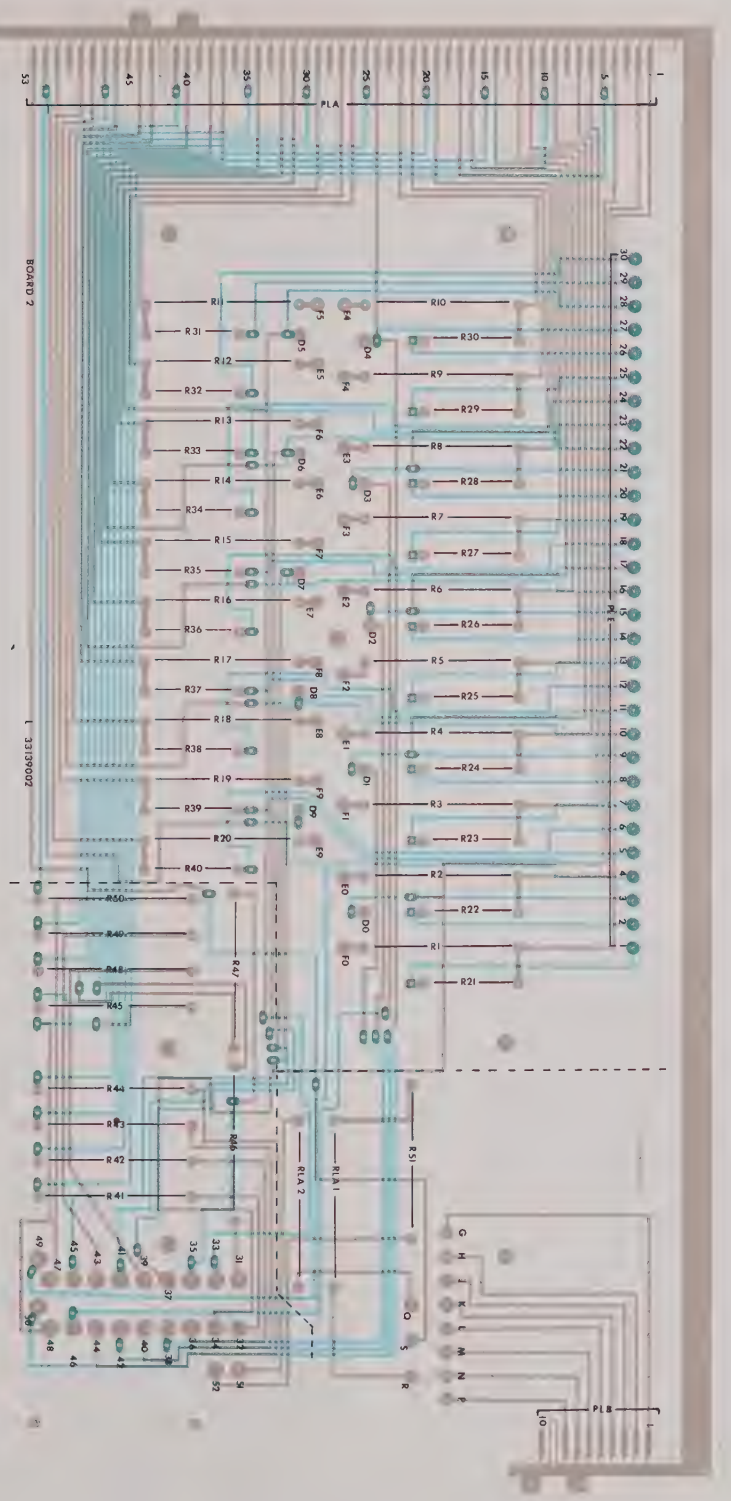


Fig. 20 Component Location; pcb 33139002

Component Parts List
for
Printed Circuit Board 33159001
(Control Panel 3315)

Cct Ref.	General Description				Solartron Part No.
RV11	CMPM	1k	3/4W	20%	124031000

Component Parts List
for
Printed Circuit Board 33169001
(Control Panel 3316)

Cct Ref.	General Description				Solartron Part No.
RV11 to RV20	CMPM	1k	3/4W	20%	124031000

Component Parts List
for
Printed Circuit Board 33159002
(Control Panel 3315)

Cct Ref.	General Description				Solartron Part No.
RV1 to RV10	CMPM	5k	3/4W	20%	124035001
SKE	PCB edge connector 16 way double sided flow solder				352516280
	Polarising Key				354003791

Component Parts List
for
Printed Circuit Board 33169002
(Control Panel 3316)

Cct Ref.	General Description				Solartron Part No.
RV1 to RV10	CMPM	5k	3/4W	20%	124035001
SKE	PCB edge connector 16 way double sided flow solder				352516280
	Polarising Key				354003791

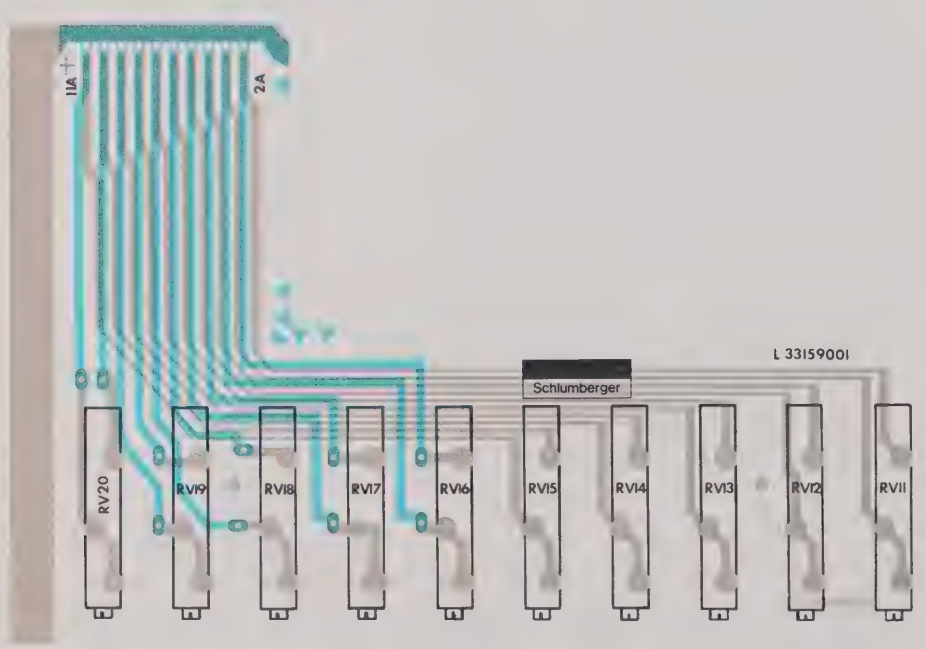
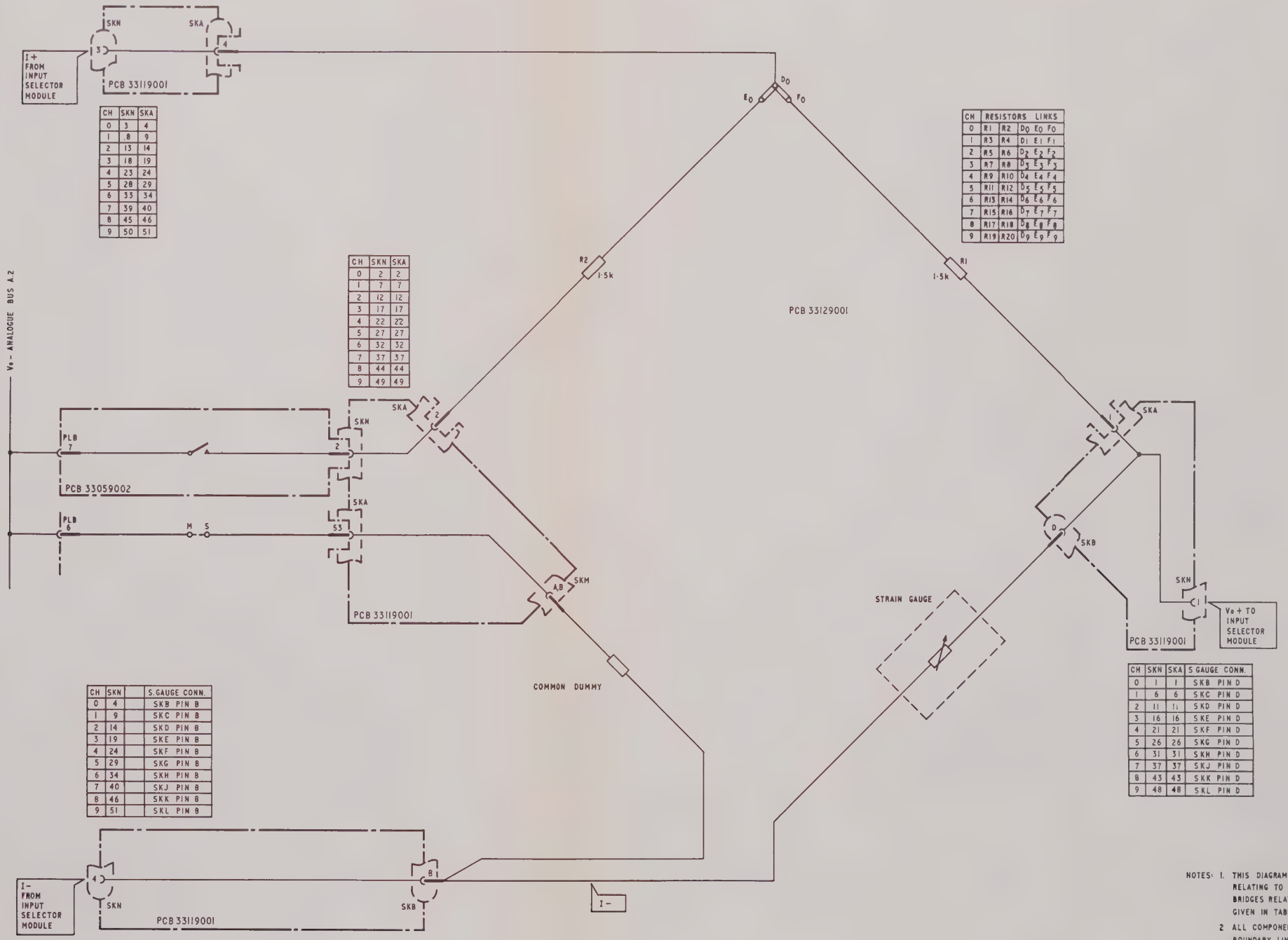


Fig. 21 Component Location; pcb 33159001



CH	SKN	SKA
0	3	4
1	8	9
2	13	14
3	18	19
4	23	24
5	28	29
6	33	34
7	39	40
8	45	46
9	50	51

CH	SKN	SKA
0	2	2
1	7	7
2	12	12
3	17	17
4	22	22
5	27	27
6	32	32
7	37	37
8	44	44
9	49	49

CH	RESISTORS		LINKS		
0	R1	R2	D_0	E_0	F_0
1	R3	R4	D_1	E_1	F_1
2	R5	R6	D_2	E_2	F_2
3	R7	R8	D_3	E_3	F_3
4	R9	R10	D_4	E_4	F_4
5	R11	R12	D_5	E_5	F_5
6	R13	R14	D_6	E_6	F_6
7	R15	R16	D_7	E_7	F_7
8	R17	R18	D_8	E_8	F_8
9	R19	R20	D_9	E_9	F_9

CH	SKN		S.GAUGE CONN.
0	4		SKB PIN B
1	9		SKC PIN B
2	14		SKD PIN B
3	19		SKE PIN B
4	24		SKF PIN B
5	29		SKG PIN B
6	34		SKH PIN B
7	40		SKJ PIN B
8	46		SKK PIN B
9	51		SKL PIN B

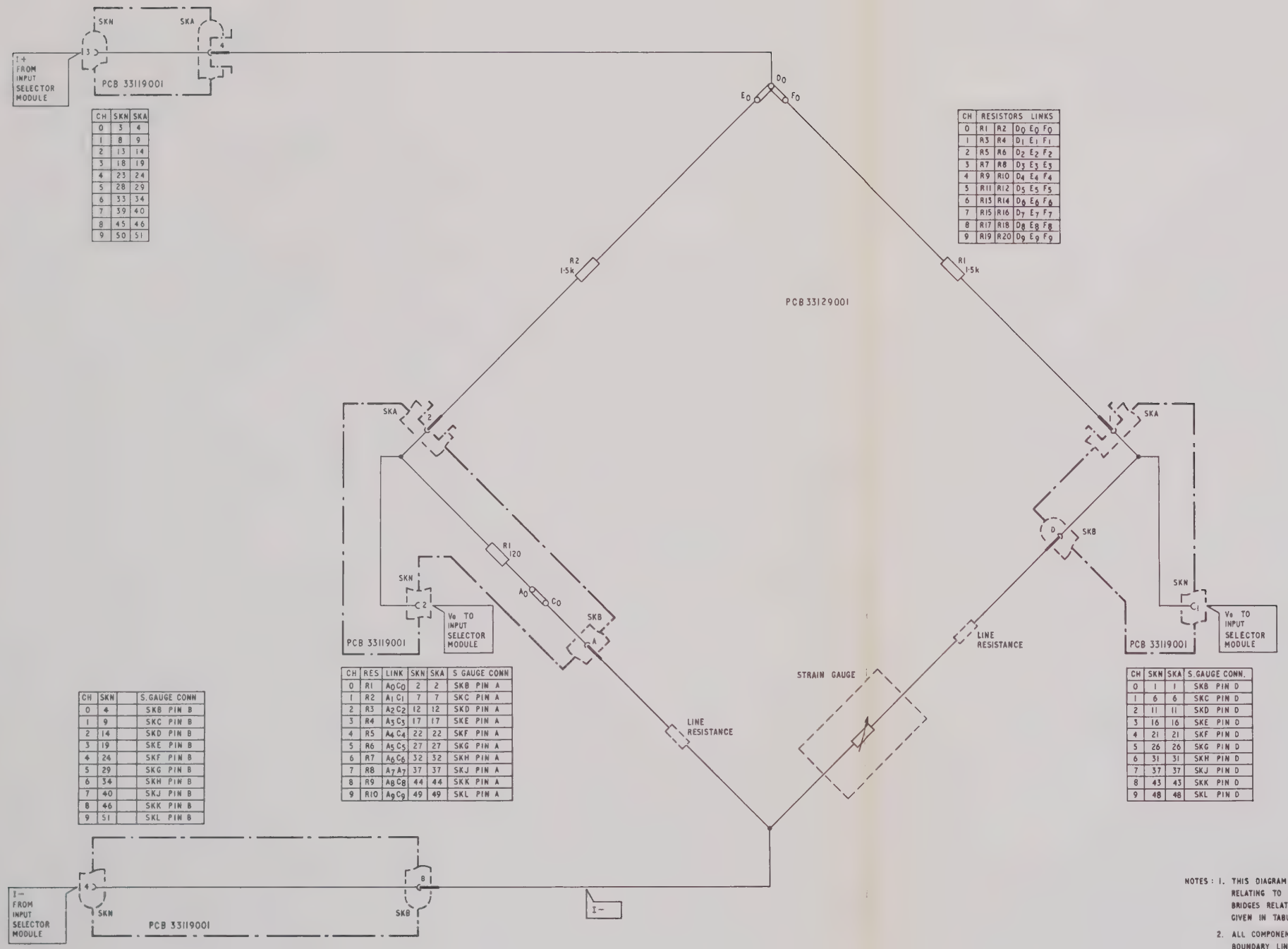
CH	SKN	SKA	S GAUGE CONN.
0	1	1	SKB PIN D
1	6	6	SKC PIN D
2	11	11	SKD PIN D
3	16	16	SKE PIN D
4	21	21	SKF PIN D
5	26	26	SKG PIN D
6	31	31	SKH PIN D
7	37	37	SKJ PIN D
8	43	43	SKK PIN D
9	48	48	SKL PIN D

NOTES: 1. THIS DIAGRAM SHOWS THE BRIDGE CIRCUIT RELATING TO CHANNEL '0'. DETAILS OF THE BRIDGES RELATING TO CHANNELS 1–9 ARE GIVEN IN TABULAR FORM

2 ALL COMPONENTS NOT ENCLOSED BY A BOUNDARY LINE ARE ON PCB 33129001

STRAIN GAUGE OPTION A.1

USING COMMON DUMMY



CH	SKN	SKA
0	3	4
1	8	9
2	13	14
3	18	19
4	23	24
5	28	29
6	33	34
7	39	40
8	45	46
9	50	51

CH	RESISTORS		LINKS
0	R1	R2	D_0 E_0 F_0
1	R3	R4	D_1 E_1 F_1
2	R5	R6	D_2 E_2 F_2
3	R7	R8	D_3 E_3 E_3
4	R9	R10	D_4 E_4 F_4
5	R11	R12	D_5 E_5 F_5
6	R13	R14	D_6 E_6 F_6
7	R15	R16	D_7 E_7 F_7
8	R17	R18	D_8 E_8 F_8
9	R19	R20	D_9 E_9 F_9

CH	RES	LINK	SKN	SKA	S GAUGE CONN
0	R1	A_0C_0	2	2	SKB PIN A
1	R2	A_1C_1	7	7	SKC PIN A
2	R3	A_2C_2	12	12	SKD PIN A
3	R4	A_3C_3	17	17	SKE PIN A
4	R5	A_4C_4	22	22	SKF PIN A
5	R6	A_5C_5	27	27	SKG PIN A
6	R7	A_6C_6	32	32	SKH PIN A
7	R8	A_7A_7	37	37	SKJ PIN A
8	R9	A_8C_8	44	44	SKK PIN A
9	R10	A_9C_9	49	49	SKL PIN A

CH	SKN		S.GAUGE CONN
0	4		SKB PIN B
1	9		SKC PIN B
2	14		SKD PIN B
3	19		SKE PIN B
4	24		SKF PIN B
5	29		SKG PIN B
6	34		SKH PIN B
7	40		SKJ PIN B
8	46		SKK PIN B
9	51		SKL PIN B

CH	SKN	SKA	S.GAUGE CONN.
0	1	1	SKB PIN D
1	6	6	SKC PIN D
2	11	11	SKD PIN D
3	16	16	SKE PIN D
4	21	21	SKF PIN D
5	26	26	SKG PIN D
6	31	31	SKH PIN D
7	37	37	SKJ PIN D
8	43	43	SKK PIN D
9	48	48	SKL PIN D

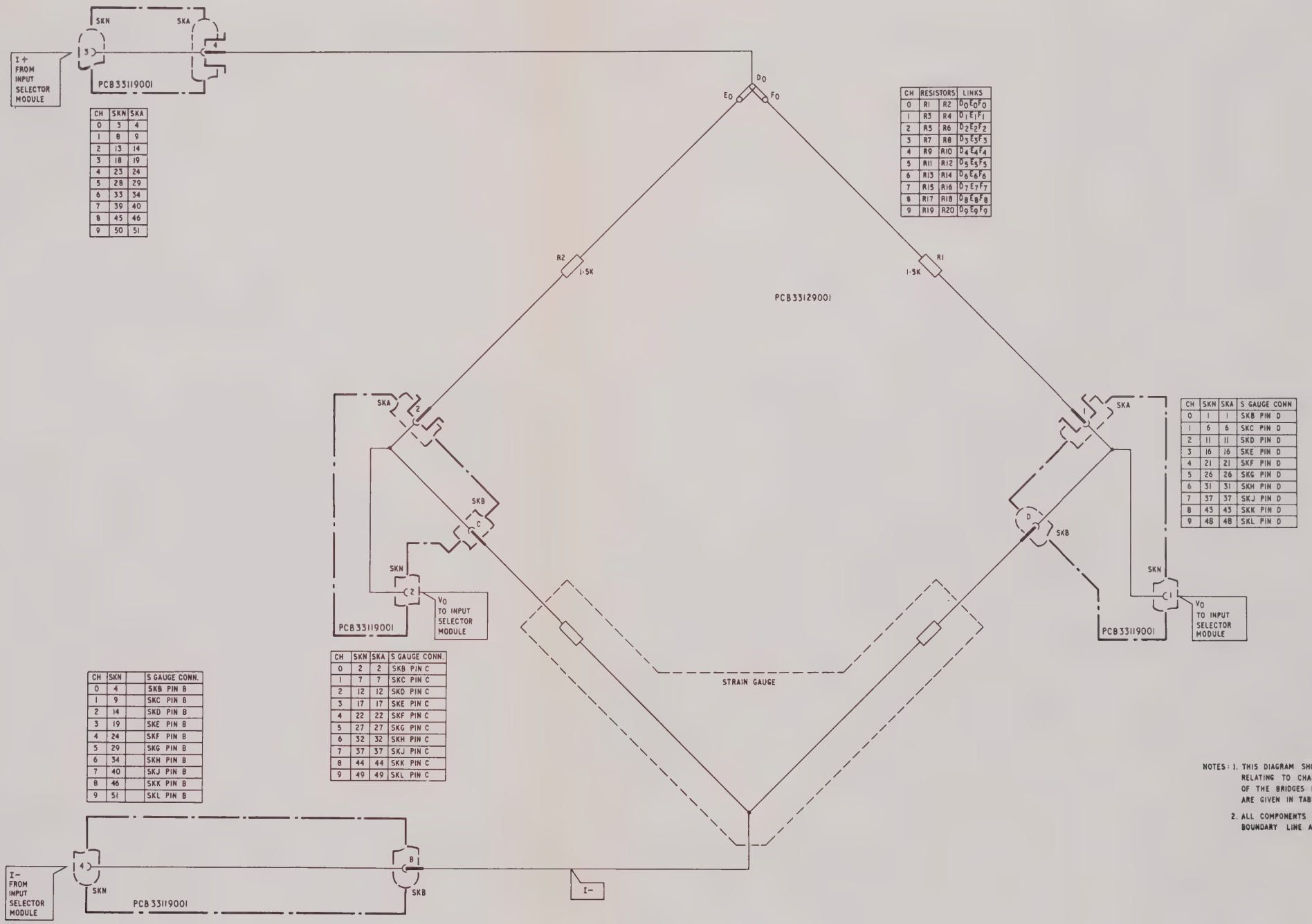
NOTES : 1. THIS DIAGRAM SHOWS THE BRIDGE CIRCUIT RELATING TO CHANNEL '0.' DETAILS OF THE BRIDGES RELATING TO CHANNELS 1-9 ARE GIVEN IN TABULAR FORM.

2. ALL COMPONENTS NOT ENCLOSED BY A BOUNDARY LINE ARE ON PCB 33129001.

STRAIN GAUGE OPTION A.1

No Balance, No Scale - 3311, 3312

Quarter Bridge Configuration



CH	SKN	SKA
0	3	4
1	8	9
2	13	14
3	18	19
4	23	24
5	28	29
6	33	34
7	39	40
8	45	46
9	50	51

CH	RESISTORS		LINKS
0	R1	R2	$D_0E_0F_0$
1	R3	R4	$D_1E_1F_1$
2	R5	R6	$D_2E_2F_2$
3	R7	R8	$D_3E_3F_3$
4	R9	R10	$D_4E_4F_4$
5	R11	R12	$D_5E_5F_5$
6	R13	R14	$D_6E_6F_6$
7	R15	R16	$D_7E_7F_7$
8	R17	R18	$D_8E_8F_8$
9	R19	R20	$D_9E_9F_9$

CH	SKN	SKA	S GAUGE CONN
0	1	1	SKB PIN D
1	6	6	SKC PIN D
2	11	11	SKD PIN D
3	16	16	SKE PIN D
4	21	21	SKF PIN D
5	26	26	SKG PIN D
6	31	31	SKH PIN D
7	37	37	SKJ PIN D
8	43	43	SKK PIN D
9	48	48	SKL PIN D

CH	SKN	SKA	S GAUGE CONN.
0	2	2	SKB PIN C
1	7	7	SKC PIN C
2	12	12	SKD PIN C
3	17	17	SKE PIN C
4	22	22	SKF PIN C
5	27	27	SKG PIN C
6	32	32	SKH PIN C
7	37	37	SKJ PIN C
8	44	44	SKK PIN C
9	49	49	SKL PIN C

CH	SKN		S GAUGE CONN.
0	4		SKB PIN B
1	9		SKC PIN B
2	14		SKD PIN B
3	19		SKE PIN B
4	24		SKF PIN B
5	29		SKG PIN B
6	34		SKH PIN B
7	40		SKJ PIN B
8	46		SKK PIN B
9	51		SKL PIN B

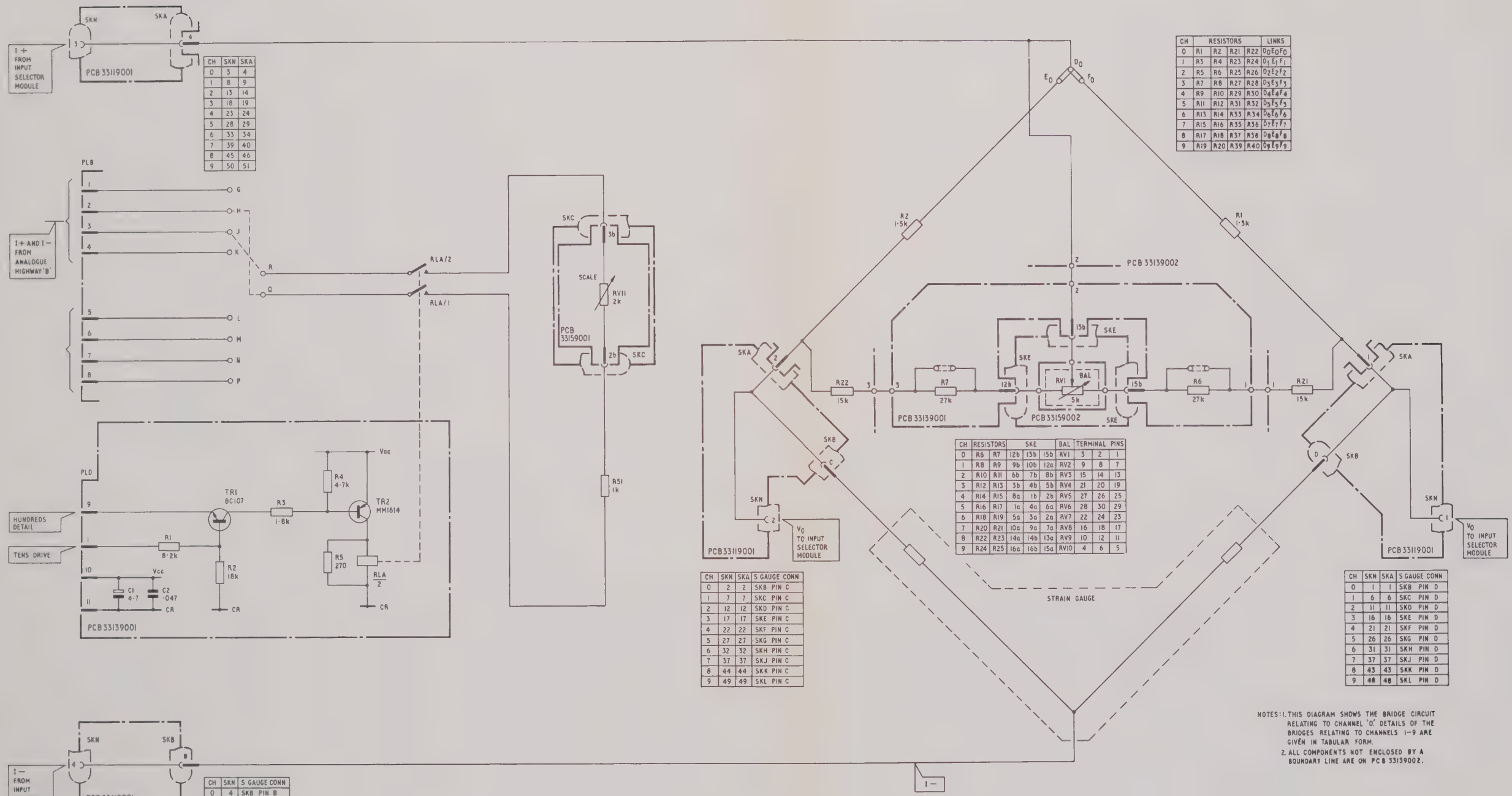
NOTES: 1. THIS DIAGRAM SHOWS THE BRIDGE CIRCUIT RELATING TO CHANNEL '0' DETAILS OF THE BRIDGES RELATING TO CHANNELS 1-9 ARE GIVEN IN TABULAR FORM.

2. ALL COMPONENTS NOT ENCLOSED BY A BOUNDARY LINE ARE ON PCB 33129001

STRAIN GAUGE OPTION A.2

No Balance, No Scale - 3311, 3312

Half Bridge Configuration



CH	SKN	SKA
0	3	4
1	8	9
2	13	14
3	18	19
4	23	24
5	28	29
6	33	34
7	39	40
8	45	46
9	50	51

CH	RESISTORS				LINKS
0	R1	R2	R21	R22	$D_0E_0F_0$
1	R3	R4	R23	R24	$D_1E_1F_1$
2	R5	R6	R25	R26	$D_2E_2F_2$
3	R7	R8	R27	R28	$D_3E_3F_3$
4	R9	R10	R29	R30	$D_4E_4F_4$
5	R11	R12	R31	R32	$D_5E_5F_5$
6	R13	R14	R33	R34	$D_6E_6F_6$
7	R15	R16	R35	R36	$D_7E_7F_7$
8	R17	R18	R37	R38	$D_8E_8F_8$
9	R19	R20	R39	R40	$D_9E_9F_9$

CH	RESISTORS		SKE			BAL	TERMINAL PINS		
0	R6	R7	12b	13b	15b	RV1	3	2	1
1	R8	R9	9b	10b	12a	RV2	9	8	7
2	R10	R11	6b	7b	8b	RV3	15	14	13
3	R12	R13	3b	4b	5b	RV4	21	20	19
4	R14	R15	8a	1b	2b	RV5	27	26	25
5	R16	R17	1a	4a	6a	RV6	28	30	29
6	R18	R19	5a	3a	2a	RV7	22	24	23
7	R20	R21	10a	9a	7a	RV8	16	18	17
8	R22	R23	14a	14b	13a	RV9	10	12	11
9	R24	R25	16a	16b	15a	RV10	4	6	5

CH	SKN	SKA	S GAUGE CONN
0	2	2	SKB PIN C
1	7	7	SKC PIN C
2	12	12	SKD PIN C
3	17	17	SKE PIN C
4	22	22	SKF PIN C
5	27	27	SKG PIN C
6	32	32	SKH PIN C
7	37	37	SKJ PIN C
8	44	44	SKK PIN C
9	49	49	SKL PIN C

CH	SKN	SKA	S GAUGE CONN
0	1	1	SKB PIN D
1	6	6	SKC PIN D
2	11	11	SKD PIN D
3	16	16	SKE PIN D
4	21	21	SKF PIN D
5	26	26	SKG PIN D
6	31	31	SKH PIN D
7	37	37	SKJ PIN D
8	43	43	SKK PIN D
9	48	48	SKL PIN D

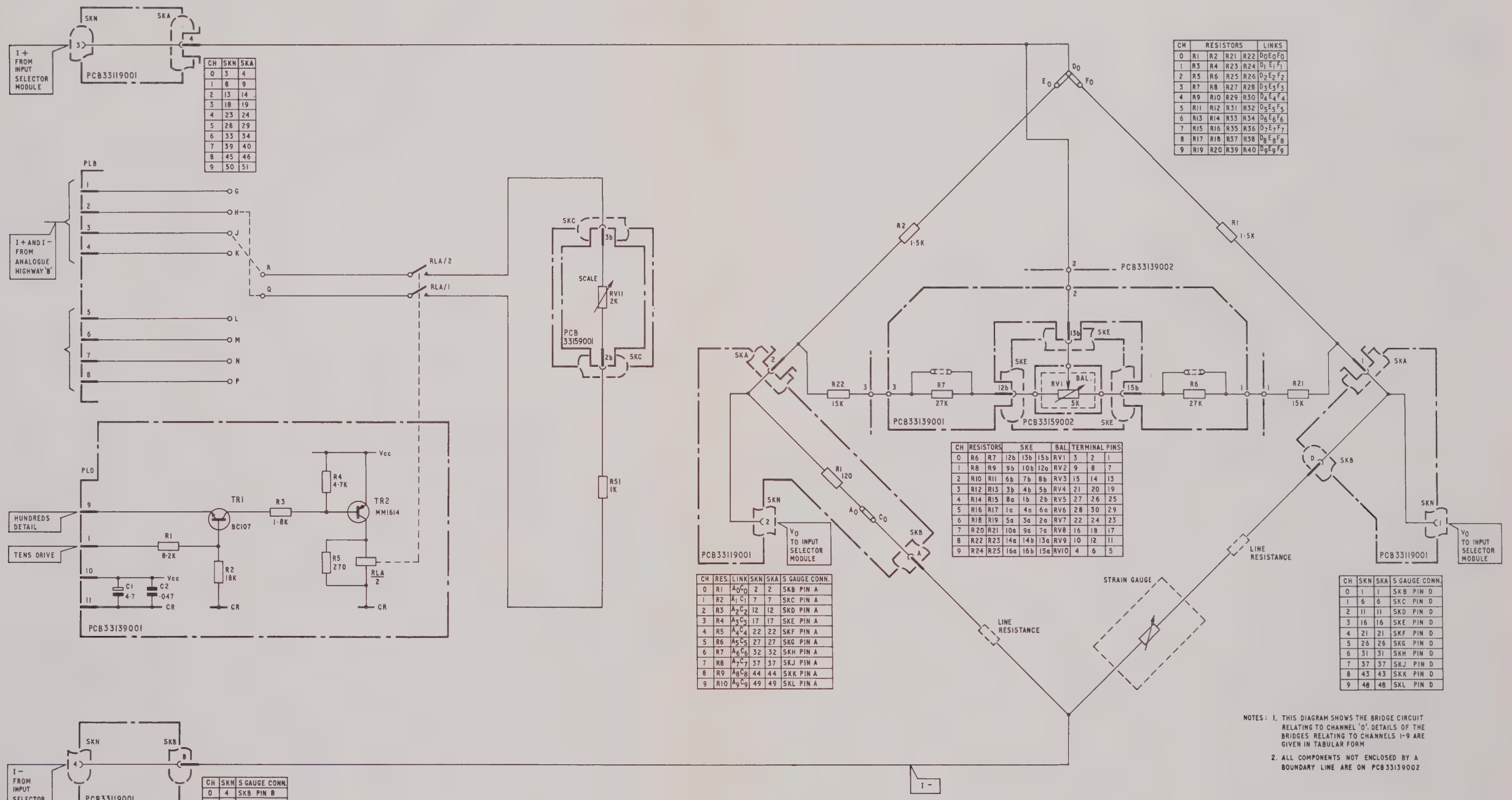
CH	SKN	S GAUGE CONN
0	4	SKB PIN B
1	9	SKC PIN B
2	14	SKD PIN B
3	19	SKE PIN B
4	24	SKF PIN B
5	29	SKG PIN B
6	34	SKH PIN B
7	40	SKJ PIN B
8	46	SKK PIN B
9	51	SKL PIN B

NOTES: 1. THIS DIAGRAM SHOWS THE BRIDGE CIRCUIT RELATING TO CHANNEL '0.' DETAILS OF THE BRIDGES RELATING TO CHANNELS 1–9 ARE GIVEN IN TABULAR FORM.
2. ALL COMPONENTS NOT ENCLOSED BY A BOUNDARY LINE ARE ON PCB 33139002.

STRAIN GAUGE OPTION B.1

Individual Bridge Balance, Common Scale - 3311, 3313, 3315

Quarter Bridge Configuration



CH	SKN	SKA
0	3	4
1	8	9
2	13	14
3	18	19
4	23	24
5	28	29
6	33	34
7	39	40
8	45	46
9	50	51

CH	RESISTORS				LINKS
0	R1	R2	R21	R22	$D_0E_0F_0$
1	R3	R4	R23	R24	$D_1E_1F_1$
2	R5	R6	R25	R26	$D_2E_2F_2$
3	R7	R8	R27	R28	$D_3E_3F_3$
4	R9	R10	R29	R30	$D_4E_4F_4$
5	R11	R12	R31	R32	$D_5E_5F_5$
6	R13	R14	R33	R34	$D_6E_6F_6$
7	R15	R16	R35	R36	$D_7E_7F_7$
8	R17	R18	R37	R38	$D_8E_8F_8$
9	R19	R20	R39	R40	$D_9E_9F_9$

CH	RESISTORS		SKE			BAL	TERMINAL PINS		
0	R6	R7	12b	13b	15b	RV1	3	2	1
1	R8	R9	9b	10b	12a	RV2	9	8	7
2	R10	R11	6b	7b	8b	RV3	15	14	13
3	R12	R13	3b	4b	5b	RV4	21	20	19
4	R14	R15	8a	1b	2b	RV5	27	26	25
5	R16	R17	1a	4a	6a	RV6	28	30	29
6	R18	R19	5a	3a	2a	RV7	22	24	23
7	R20	R21	10a	9a	7a	RV8	16	18	17
8	R22	R23	14a	14b	13a	RV9	10	12	11
9	R24	R25	16a	16b	15a	RV10	4	6	5

CH	RES.	LINK	SKN	SKA	S GAUGE CONN.
0	R1	A_0C_0	2	2	SKB PIN A
1	R2	A_1C_1	7	7	SKC PIN A
2	R3	A_2C_2	12	12	SKD PIN A
3	R4	A_3C_3	17	17	SKE PIN A
4	R5	A_4C_4	22	22	SKF PIN A
5	R6	A_5C_5	27	27	SKG PIN A
6	R7	A_6C_6	32	32	SKH PIN A
7	R8	A_7C_7	37	37	SKJ PIN A
8	R9	A_8C_8	44	44	SKK PIN A
9	R10	A_9C_9	49	49	SKL PIN A

CH	SKN	SKA	S GAUGE CONN.
0	1	1	SKB PIN D
1	6	6	SKC PIN D
2	11	11	SKD PIN D
3	16	16	SKE PIN D
4	21	21	SKF PIN D
5	26	26	SKG PIN D
6	31	31	SKH PIN D
7	37	37	SKJ PIN D
8	43	43	SKK PIN D
9	48	48	SKL PIN D

CH	SKN	S GAUGE CONN.
0	4	SKB PIN B
1	9	SKC PIN B
2	14	SKD PIN B
3	19	SKE PIN B
4	24	SKF PIN B
5	29	SKG PIN B
6	34	SKH PIN B
7	40	SKJ PIN B
8	46	SKK PIN B
9	51	SKL PIN B

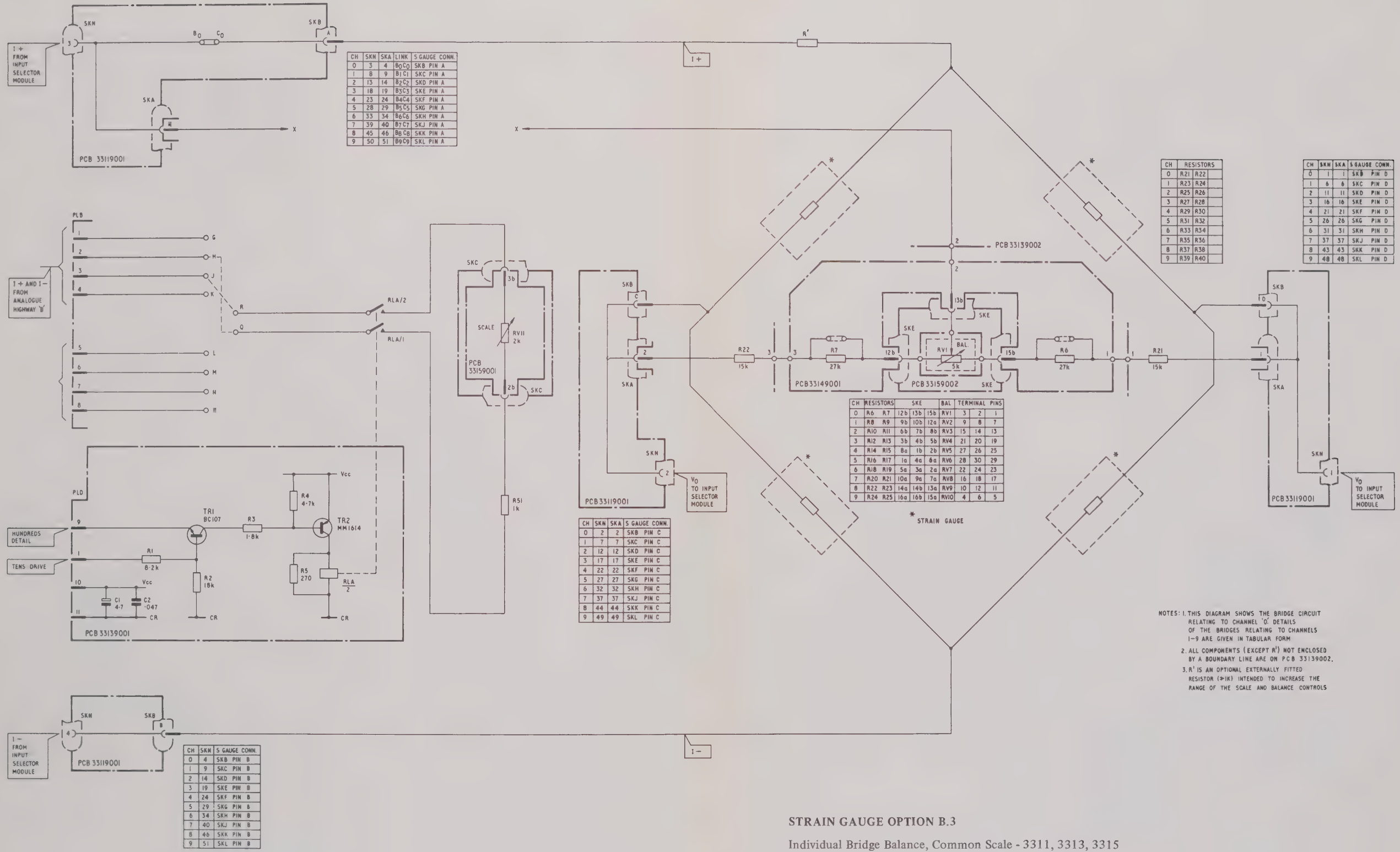
NOTES: 1. THIS DIAGRAM SHOWS THE BRIDGE CIRCUIT RELATING TO CHANNEL '0'. DETAILS OF THE BRIDGES RELATING TO CHANNELS 1-9 ARE GIVEN IN TABULAR FORM

2. ALL COMPONENTS NOT ENCLOSED BY A BOUNDARY LINE ARE ON PCB33139002

STRAIN GAUGE OPTION B.2

Individual Bridge Balance, Common Scale - 3311, 3313, 3315

Half Bridge Configuration



CH	SKN	SKA	LINK	S GAUGE CONN.
0	3	4	B_0C_0	SKB PIN A
1	8	9	B_1C_1	SKC PIN A
2	13	14	B_2C_2	SKD PIN A
3	18	19	B_3C_3	SKE PIN A
4	23	24	B_4C_4	SKF PIN A
5	28	29	B_5C_5	SKG PIN A
6	33	34	B_6C_6	SKH PIN A
7	39	40	B_7C_7	SKJ PIN A
8	45	46	B_8C_8	SKK PIN A
9	50	51	B_9C_9	SKL PIN A

CH	RESISTORS	
0	R21	R22
1	R23	R24
2	R25	R26
3	R27	R28
4	R29	R30
5	R31	R32
6	R33	R34
7	R35	R36
8	R37	R38
9	R39	R40

CH	SKN	SKA	S GAUGE CONN.
0	1	1	SKB PIN D
1	6	6	SKC PIN D
2	11	11	SKD PIN D
3	16	16	SKE PIN D
4	21	21	SKF PIN D
5	26	26	SKG PIN D
6	31	31	SKH PIN D
7	37	37	SKJ PIN D
8	43	43	SKK PIN D
9	48	48	SKL PIN D

CH	SKN	SKA	S GAUGE CONN.
0	2	2	SKB PIN C
1	7	7	SKC PIN C
2	12	12	SKD PIN C
3	17	17	SKE PIN C
4	22	22	SKF PIN C
5	27	27	SKG PIN C
6	32	32	SKH PIN C
7	37	37	SKJ PIN C
8	44	44	SKK PIN C
9	49	49	SKL PIN C

CH	RESISTORS		SKE			BAL	TERMINAL		PINS
0	R6	R7	12b	13b	15b	RV1	3	2	1
1	R8	R9	9b	10b	12a	RV2	9	8	7
2	R10	R11	6b	7b	8b	RV3	15	14	13
3	R12	R13	3b	4b	5b	RV4	21	20	19
4	R14	R15	8a	1b	2b	RV5	27	26	25
5	R16	R17	1a	4a	6a	RV6	28	30	29
6	R18	R19	5a	3a	2a	RV7	22	24	23
7	R20	R21	10a	9a	7a	RV8	16	18	17
8	R22	R23	14a	14b	13a	RV9	10	12	11
9	R24	R25	16a	16b	15a	RV10	4	6	5

CH	SKN	S GAUGE CONN.
0	4	SKB PIN B
1	9	SKC PIN B
2	14	SKD PIN B
3	19	SKE PIN B
4	24	SKF PIN B
5	29	SKG PIN B
6	34	SKH PIN B
7	40	SKJ PIN B
8	46	SKK PIN B
9	51	SKL PIN B

NOTES: 1. THIS DIAGRAM SHOWS THE BRIDGE CIRCUIT RELATING TO CHANNEL '0' DETAILS OF THE BRIDGES RELATING TO CHANNELS 1–9 ARE GIVEN IN TABULAR FORM

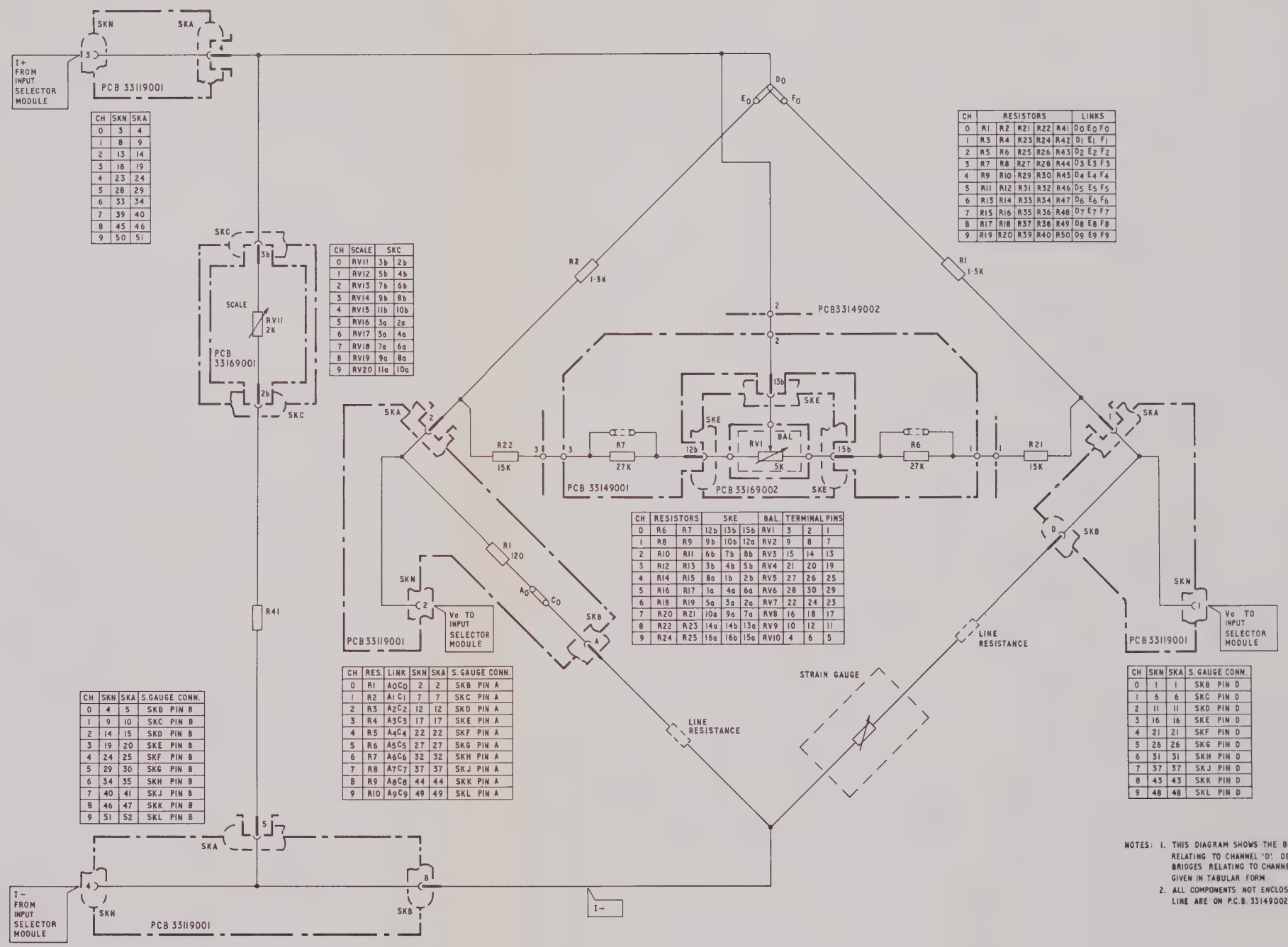
2. ALL COMPONENTS (EXCEPT R') NOT ENCLOSED BY A BOUNDARY LINE ARE ON PCB 33139002.

3. R' IS AN OPTIONAL EXTERNALLY FITTED RESISTOR (≯1K) INTENDED TO INCREASE THE RANGE OF THE SCALE AND BALANCE CONTROLS

STRAIN GAUGE OPTION B.3

Individual Bridge Balance, Common Scale - 3311, 3313, 3315

Full Bridge Configuration



CH	SKN	SKA
0	3	4
1	8	9
2	13	14
3	18	19
4	23	24
5	28	29
6	33	34
7	39	40
8	45	46
9	50	51

CH	SCALE	SKC	
0	RV11	3b	2b
1	RV12	5b	4b
2	RV13	7b	6b
3	RV14	9b	8b
4	RV15	11b	10b
5	RV16	3a	2a
6	RV17	5a	4a
7	RV18	7a	6a
8	RV19	9a	8a
9	RV20	11a	10a

CH	RESISTORS					LINKS
0	R1	R2	R21	R22	R41	D0 E0 F0
1	R3	R4	R23	R24	R42	D1 E1 F1
2	R5	R6	R25	R26	R43	D2 E2 F2
3	R7	R8	R27	R28	R44	D3 E3 F3
4	R9	R10	R29	R30	R45	D4 E4 F4
5	R11	R12	R31	R32	R46	D5 E5 F5
6	R13	R14	R33	R34	R47	D6 E6 F6
7	R15	R16	R35	R36	R48	D7 E7 F7
8	R17	R18	R37	R38	R49	D8 E8 F8
9	R19	R20	R39	R40	R50	D9 E9 F9

CH	RESISTORS		SKE			BAL.	TERMINAL PINS		
0	R6	R7	12b	13b	15b	RV1	3	2	1
1	R8	R9	9b	10b	12a	RV2	9	8	7
2	R10	R11	6b	7b	8b	RV3	15	14	13
3	R12	R13	3b	4b	5b	RV4	21	20	19
4	R14	R15	8a	1b	2b	RV5	27	26	25
5	R16	R17	1a	4a	6a	RV6	28	30	29
6	R18	R19	5a	3a	2a	RV7	22	24	23
7	R20	R21	10a	9a	7a	RV8	16	18	17
8	R22	R23	14a	14b	13a	RV9	10	12	11
9	R24	R25	16a	16b	15a	RV10	4	6	5

CH	RES.	LINK	SKN	SKA	S. GAUGE CONN.
0	R1	A0C0	2	2	SKB PIN A
1	R2	A1C1	7	7	SKC PIN A
2	R3	A2C2	12	12	SKD PIN A
3	R4	A3C3	17	17	SKE PIN A
4	R5	A4C4	22	22	SKF PIN A
5	R6	A5C5	27	27	SKG PIN A
6	R7	A6C6	32	32	SKH PIN A
7	R8	A7C7	37	37	SKJ PIN A
8	R9	A8C8	44	44	SKK PIN A
9	R10	A9C9	49	49	SKL PIN A

CH	SKN	SKA	S.GAUGE CONN.
0	4	5	SKB PIN B
1	9	10	SKC PIN B
2	14	15	SKD PIN B
3	19	20	SKE PIN B
4	24	25	SKF PIN B
5	29	30	SKG PIN B
6	34	35	SKH PIN B
7	40	41	SKJ PIN B
8	46	47	SKK PIN B
9	51	52	SKL PIN B

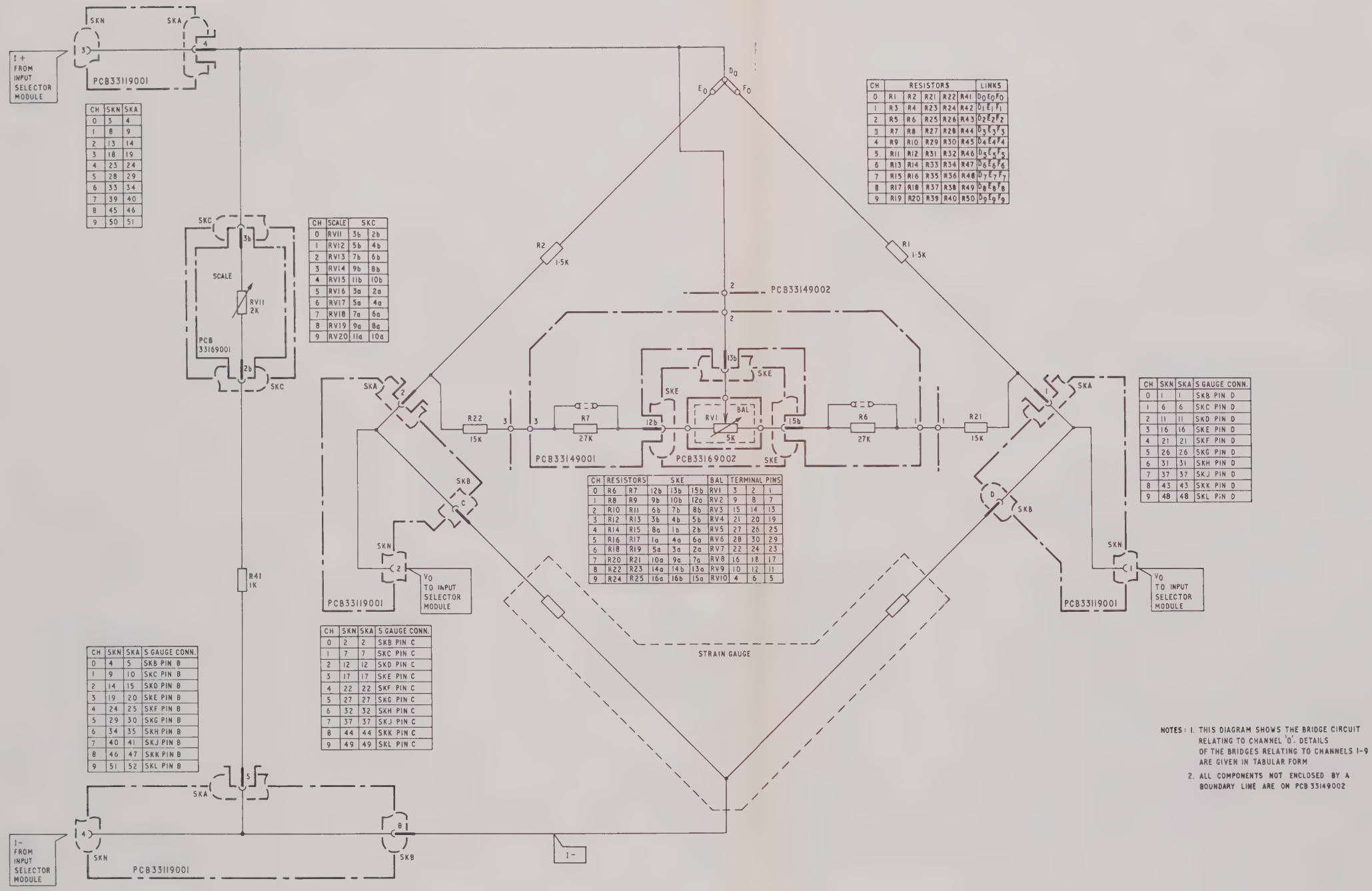
CH	SKN	SKA	S.GAUGE CONN.
0	1	1	SKB PIN D
1	6	6	SKC PIN D
2	11	11	SKD PIN D
3	16	16	SKE PIN D
4	21	21	SKF PIN D
5	26	26	SKG PIN D
6	31	31	SKH PIN D
7	37	37	SKJ PIN D
8	43	43	SKK PIN D
9	48	48	SKL PIN D

NOTES: 1. THIS DIAGRAM SHOWS THE BRIDGE CIRCUIT RELATING TO CHANNEL '0'. DETAILS OF THE BRIDGES RELATING TO CHANNELS 1–9 ARE GIVEN IN TABULAR FORM.
2. ALL COMPONENTS NOT ENCLOSED BY A BOUNDARY LINE ARE ON P.C.B. 33149002.

STRAIN GAUGE OPTION C.1

Individual Bridge Balance, Individual Channel Scale - 3311, 3314, 3316

Quarter Bridge Configuration



CH	SKN	SKA
0	3	4
1	8	9
2	13	14
3	18	19
4	23	24
5	28	29
6	33	34
7	39	40
8	45	46
9	50	51

CH	SCALE	SKC	
0	RV11	3b	2b
1	RV12	5b	4b
2	RV13	7b	6b
3	RV14	9b	8b
4	RV15	11b	10b
5	RV16	3a	2a
6	RV17	5a	4a
7	RV18	7a	6a
8	RV19	9a	8a
9	RV20	11a	10a

CH	RESISTORS				LINKS
0	R1	R2	R21	R22	R41	$D_0E_0F_0$
1	R3	R4	R23	R24	R42	$D_1E_1F_1$
2	R5	R6	R25	R26	R43	$D_2E_2F_2$
3	R7	R8	R27	R28	R44	$D_3E_3F_3$
4	R9	R10	R29	R30	R45	$D_4E_4F_4$
5	R11	R12	R31	R32	R46	$D_5E_5F_5$
6	R13	R14	R33	R34	R47	$D_6E_6F_6$
7	R15	R16	R35	R36	R48	$D_7E_7F_7$
8	R17	R18	R37	R38	R49	$D_8E_8F_8$
9	R19	R20	R39	R40	R50	$D_9E_9F_9$

CH	RESISTORS		SKE			BAL	TERMINAL PINS		
0	R6	R7	12b	13b	15b	RV1	3	2	1
1	R8	R9	9b	10b	12a	RV2	9	8	7
2	R10	R11	6b	7b	8b	RV3	15	14	13
3	R12	R13	3b	4b	5b	RV4	21	20	19
4	R14	R15	8a	1b	2b	RV5	27	26	25
5	R16	R17	1a	4a	6a	RV6	28	30	29
6	R18	R19	5a	3a	2a	RV7	22	24	23
7	R20	R21	10a	9a	7a	RV8	16	18	17
8	R22	R23	14a	14b	13a	RV9	10	12	11
9	R24	R25	16a	16b	15a	RV10	4	6	5

CH	SKN	SKA	S GAUGE CONN.
0	1	1	SKB PIN D
1	6	6	SKC PIN D
2	11	11	SKD PIN D
3	16	16	SKE PIN D
4	21	21	SKF PIN D
5	26	26	SKG PIN D
6	31	31	SKH PIN D
7	37	37	SKJ PIN D
8	43	43	SKK PIN D
9	48	48	SKL PIN D

CH	SKN	SKA	S GAUGE CONN.
0	4	5	SKB PIN B
1	9	10	SKC PIN B
2	14	15	SKD PIN B
3	19	20	SKE PIN B
4	24	25	SKF PIN B
5	29	30	SKG PIN B
6	34	35	SKH PIN B
7	40	41	SKJ PIN B
8	46	47	SKK PIN B
9	51	52	SKL PIN B

CH	SKN	SKA	S GAUGE CONN.
0	2	2	SKB PIN C
1	7	7	SKC PIN C
2	12	12	SKD PIN C
3	17	17	SKE PIN C
4	22	22	SKF PIN C
5	27	27	SKG PIN C
6	32	32	SKH PIN C
7	37	37	SKJ PIN C
8	44	44	SKK PIN C
9	49	49	SKL PIN C

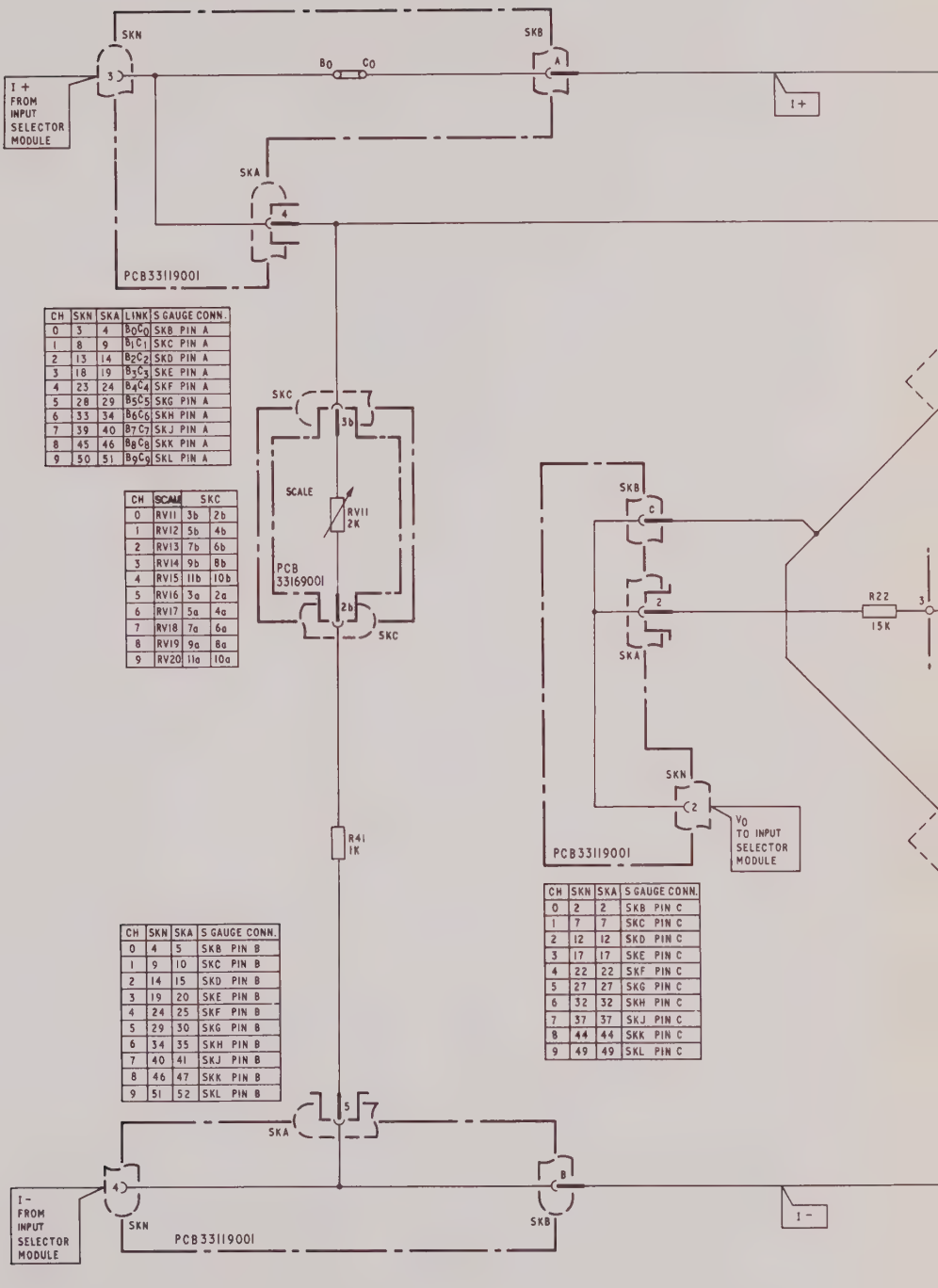
NOTES: 1. THIS DIAGRAM SHOWS THE BRIDGE CIRCUIT RELATING TO CHANNEL '0'. DETAILS OF THE BRIDGES RELATING TO CHANNELS 1-9 ARE GIVEN IN TABULAR FORM

2. ALL COMPONENTS NOT ENCLOSED BY A BOUNDARY LINE ARE ON PCB 33149002

STRAIN GAUGE OPTION C.2

Individual Bridge Balance, Individual Channel Scale - 3311, 3314, 3316

Half Bridge Configuration

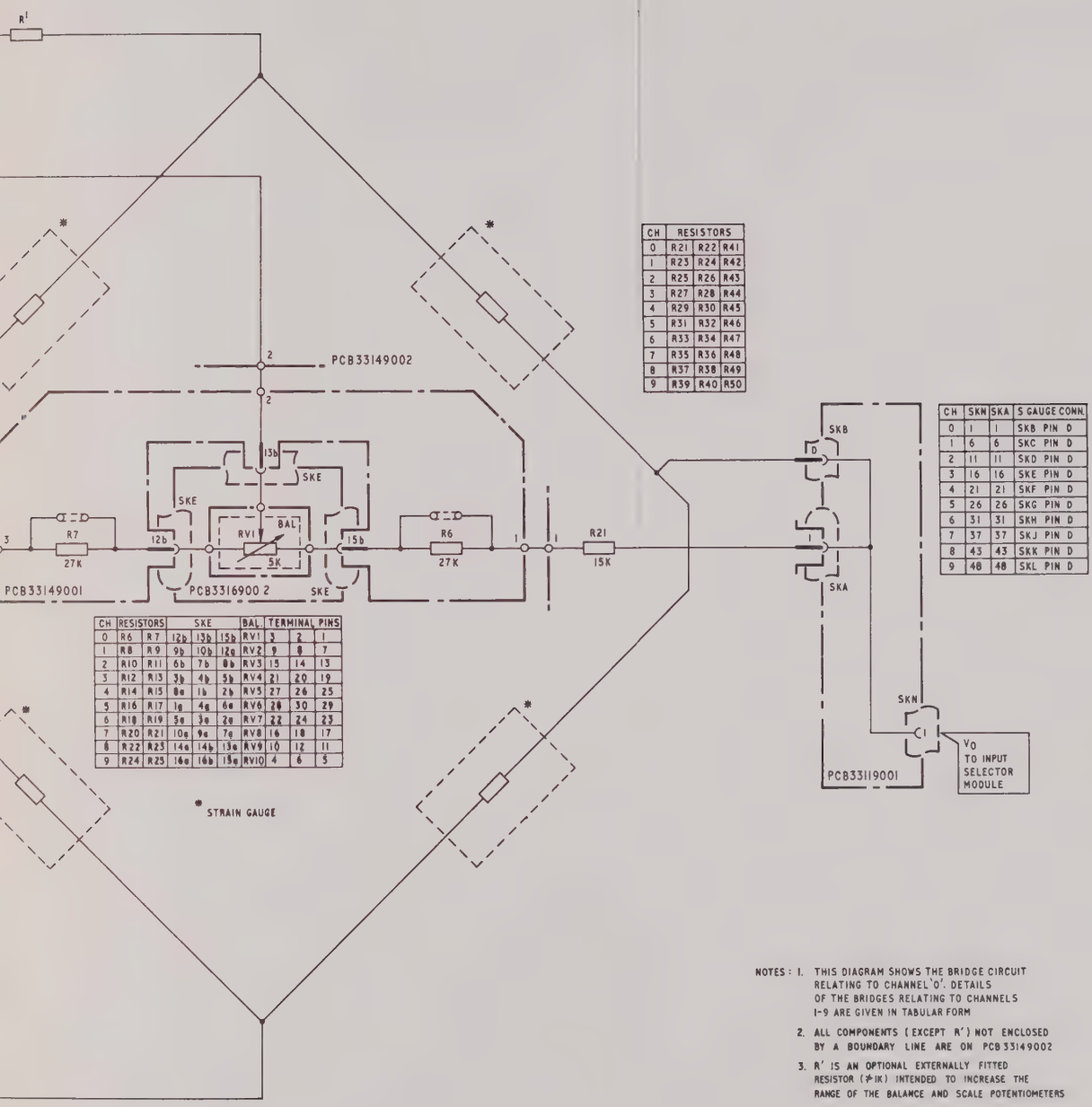


CH	SKN	SKA	LINK	S GAUGE CONN.
0	3	4	B_0C_0	SKB PIN A
1	8	9	B_1C_1	SKC PIN A
2	13	14	B_2C_2	SKD PIN A
3	18	19	B_3C_3	SKE PIN A
4	23	24	B_4C_4	SKF PIN A
5	28	29	B_5C_5	SKG PIN A
6	33	34	B_6C_6	SKH PIN A
7	39	40	B_7C_7	SKJ PIN A
8	45	46	B_8C_8	SKK PIN A
9	50	51	B_9C_9	SKL PIN A

CH	SCALE	SKC	
0	RV11	3b	2b
1	RV12	5b	4b
2	RV13	7b	6b
3	RV14	9b	8b
4	RV15	11b	10b
5	RV16	3a	2a
6	RV17	5a	4a
7	RV18	7a	6a
8	RV19	9a	8a
9	RV20	11a	10a

CH	SKN	SKA	S GAUGE CONN.
0	4	5	SKB PIN B
1	9	10	SKC PIN B
2	14	15	SKD PIN B
3	19	20	SKE PIN B
4	24	25	SKF PIN B
5	29	30	SKG PIN B
6	34	35	SKH PIN B
7	40	41	SKJ PIN B
8	46	47	SKK PIN B
9	51	52	SKL PIN B

CH	SKN	SKA	S GAUGE CONN.
0	2	2	SKB PIN C
1	7	7	SKC PIN C
2	12	12	SKD PIN C
3	17	17	SKE PIN C
4	22	22	SKF PIN C
5	27	27	SKG PIN C
6	32	32	SKH PIN C
7	37	37	SKJ PIN C
8	44	44	SKK PIN C
9	49	49	SKL PIN C



CH	RESISTORS		
0	R21	R22	R41
1	R23	R24	R42
2	R25	R26	R43
3	R27	R28	R44
4	R29	R30	R45
5	R31	R32	R46
6	R33	R34	R47
7	R35	R36	R48
8	R37	R38	R49
9	R39	R40	R50

CH	SKN	SKA	S GAUGE CONN.
0	1	1	SKB PIN D
1	6	6	SKC PIN D
2	11	11	SKD PIN D
3	16	16	SKE PIN D
4	21	21	SKF PIN D
5	26	26	SKG PIN D
6	31	31	SKH PIN D
7	37	37	SKJ PIN D
8	43	43	SKK PIN D
9	48	48	SKL PIN D

CH	RESISTORS		SKE			BAL.	TERMINAL PINS		
0	R6	R7	12b	13b	15b	RV1	3	2	1
1	R8	R9	9b	10b	12a	RV2	9	8	7
2	R10	R11	6b	7b	8b	RV3	15	14	13
3	R12	R13	3b	4b	5b	RV4	21	20	19
4	R14	R15	0a	1b	2b	RV5	27	26	25
5	R16	R17	1a	4a	6a	RV6	28	30	29
6	R18	R19	5a	3a	2a	RV7	22	24	23
7	R20	R21	10a	9a	7a	RV8	16	18	17
8	R22	R23	14a	14b	13a	RV9	10	12	11
9	R24	R25	16a	16b	15a	RV10	4	6	5

NOTES : 1. THIS DIAGRAM SHOWS THE BRIDGE CIRCUIT RELATING TO CHANNEL '0'. DETAILS OF THE BRIDGES RELATING TO CHANNELS 1-9 ARE GIVEN IN TABULAR FORM

2. ALL COMPONENTS (EXCEPT R') NOT ENCLOSED BY A BOUNDARY LINE ARE ON PCB 33149002

3. R' IS AN OPTIONAL EXTERNALLY FITTED RESISTOR (≠ IK) INTENDED TO INCREASE THE RANGE OF THE BALANCE AND SCALE POTENTIOMETERS

STRAIN GAUGE OPTION C.3

Individual Bridge Balance, Individual Channel Scale - 3311, 3314, 3316

Full Bridge Configuration

SECTION 5/5

Power Supply Units 3317/3318

INTRODUCTION

Power supply units 3317 (Fig. 1) and 3318 provide constant current sources in the range 400μA to 30mA for strain gauge circuits.

Power supply 3317 provides a single output and power supply 3318 provides two independent outputs. The two units are similar in appearance, the 3318 having two sets of front panel controls, two sets of rear panel terminals and a different mains fuse rating.

The outputs of both units are fully isolated and guarded from the mains supply and mains earth.

Fig. 1 Power Unit 3317

INPUT POWER

Both units are designed to operate from a supply of 115V/230V + 15% - 20%, 40 to 60Hz. A recessed three - pin plug (live, neutral and earth) is mounted on the rear panel (Fig. 2) for connection to the electricity supply. A standard mains lead is provided.

Fig. 2 Rear Panel of 3317

Input voltage selection is by means of a selector switch located on the rear panel. An input power fuse is also located on the rear panel and the fuse rating is detailed in Table 1. Only Slow Blow type fuses should be used.

Table 1

Supply Voltage	Fuse Rating	
	3317	3318
115V	200mA	250mA
230V	100mA	160mA

NOTE: Before switching on the power supply ensure that the selector switch is set to correspond with the mains voltage, and that the correct fuse is fitted.

The POWER on control is a red push-button switch located on the front panel of the unit (Fig. 3). An amber light on the front panel indicates that power is on.

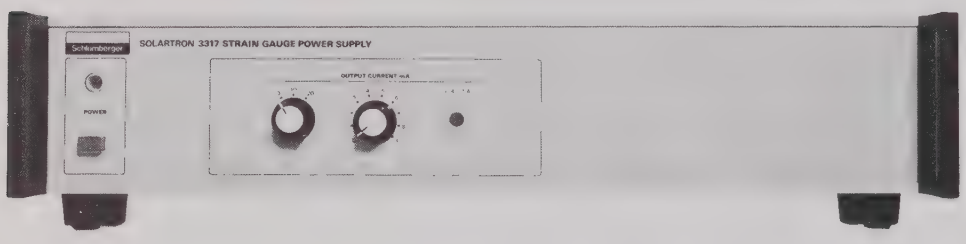


Fig. 3 Front Panel of 3317

OUTPUT CONNECTIONS (Fig. 2)

Three terminals are provided for each output. These terminals are suitable for 4mm plugs, or spade type connectors.

The terminals are located on the rear panel of the unit and are colour coded as follows:

RED	Output Current + (Current flow is out of this terminal)
BLACK	Output Current - (Current flow is into this terminal)
GREEN	Guard terminal.

Operation of the unit can be checked by connecting a 1kΩ resistor across the red and black terminals and measuring the polarity and magnitude of the voltage developed across the resistor, e.g. at a current of 1mA the voltage should be 1V with the red terminal more positive.

A standard cableform is provided for connection between the power unit output terminals and plug PLD or PLE on the scanner. This cable also provides the analogue connection between the scanner and the DVM. Cable No. 3319 is used with a DTU logger; cable No. 3329 is used with a Compact - 33 or computer based logger.

OUTPUT CONTROLS (Fig. 3)

For each output, three current controls are provided on the front panel of the unit: a three position switch changes the output current in 10mA steps from 0 to 20mA; a ten position switch changes the output current in 1mA steps from 0 to 9mA; and a multiturn potentiometer provides continuous output current adjustment in the range 400μA to 1.4mA.

For instructions on setting the controls see under Scale Adjustment in Section 5/4.

NOTE: A preset potentiometer is accessible through the rear panel. This is for setting the internal reference level and should not require further adjustment.

COMPONENT PARTS LIST

ABBREVIATIONS

Circuit References

B	Battery
C	Capacitor (μF)
CSR	Thyristor
D	Diode
FS	Fuse
IC	Integrated Circuit
L	Inductor
LP	Lamp (including Neon)
LK	Link
M	Meter
MSP	Mains Selector Panel
PL	Plug
R	Resistor (Ω)
RL	Relay
S	Switch
SK	Socket
T	Transformer
TP	Terminal Post (or Test Point)
TR	Transistor
V	Valve
X	Other Components

Also Used:-

RNL	Non Linear Resistor (Ω)
RV	Variable Resistor (Ω)

Component Composition

FIXED RESISTORS

Carbon Composition	CACP
Carbon Film	CAFM
Cracked Carbon	CKCA
Metal Film	MEFM
Metal Oxide	MEOX
Power Wirewound	POWW
Precision Wirewound	PRWW
Temperature Sensitive	TEMP
Thick Film	TKFM
Thin Film	TNFM
Voltage Sensitive	VOLT

Component Composition (Cont'd)

VARIABLE RESISTORS

Wirewound Preset Single Turn	WWPS
Wirewound Preset Multiturn	WWPM
Wirewound Front Panel Single Turn	WWFS
Wirewound Front Panel Multiturn	WWFM
Carbon Preset Single Turn	CAPS
Carbon Preset Multiturn	CAPM
Carbon Front Panel Single Turn	CAFS
Carbon Front Panel Multiturn	CAFM
Cermet Preset Single Turn	CMPS
Cermet Preset Multiturn	CMPM
Cermet Front Panel Single Turn	CMFS
Cermet Front Panel Multiturn	CMFM

CAPACITORS

Air	AIR
Aluminium Electrolytic	ALME
Aluminium Solid	ALMS
Polycarbonate	CARB
Ceramic	CERM
Polyester Foil	ESTF
Polyester Metallised	ESTM
Glass	GLAS
Mica	MICA
Metallised Lacquer	MLAC
Paper Foil	PAPF
Paper Metallised	PAPM
PTFE	PTFE
Polypropylene Film	PYLN
Polystyrene	STYR
Tantalum Dry	TAND
Tantalum Foil	TANF
Tantalum Wet	TANW

CIRCUIT DESCRIPTION

240V/110V Mains to 40V ac (floating)

The mains selector switch SB allows input power to be obtained from either 240V of 110V mains sources. In the '230V' position of switch SB the two primary windings of mains transformer T1 are connected in series to the mains source, while in the '115V' position they are connected in parallel. Mains isolation is obtained by the use of transformer T2.

Rectification and Stabilisation

The 40V ac output of transformer T2 is rectified and smoothed by diode D3 and capacitor C1 respectively, and is then stabilised by means of series regulator TR1, whose emitter is held at approximately −40V by zener diodes D1 and D2. To avoid undue demands on the stabilising circuitry the current swing at TR1 emitter is limited to approximately 10ma. This is effected by switch SB2, which connects a resistive current drain to TR1 emitter on the lower current ranges.

Output Current Control

The output current of the power supply is set by means of the CURRENT SELECT controls: switches SA and SB provide for adjustment in steps of 1ma and 10ma respectively, while variable resistor RV1 provides for fine current control.

The voltage that is developed across the CURRENT SELECT network is the product of the network resistance and the output current. This voltage is compared with a REFERENCE VOLTAGE of approximately 5.6V by comparator IC1 in the CURRENT CONTROL network. The output of comparator IC1 adjusts series regulator TR4, TR5, TR6 such that the CURRENT SELECT voltage equals the REFERENCE VOLTAGE, hence the output current is constant and equals,

$$\frac{\text{REFERENCE VOLTAGE}}{\text{CURRENT SELECT RESISTANCE}}$$

Voltage Protection

To prevent damage being caused by externally applied voltages, the power supply employs both negative and positive voltage protection.

Negative voltage protection is carried out by diode D8, which becomes reversed biased when the externally applied voltage at the I− terminal is more negative than that produced by the power supply at D8 emitter.

The POSITIVE VOLTAGE PROTECTION network becomes effective when an externally applied voltage causes the I− terminal of the power supply to become positive with respect to the I+ terminal. Transistors TR7, TR8 and TR9 are then switched on, thus switching off series regulator TR4, TR5, TR6 in the CURRENT CONTROL network.

ACCESS TO UNIT INTERIOR

Access to the interior of the 3317/3318 Power Supply is obtained as follows:-

(i) unscrew side panel retaining screws at rear of unit and slide off side panels towards rear.

(ii) slide off top panel towards rear of unit.

(iii) to obtain access to the interior of the floating box assembly, unscrew the two screws securing the cover plate and remove the plate from the assembly.

An internal view of the unit is given in Fig. 4. This shows the location of the floating box assembly, or assemblies, and the various discrete components.

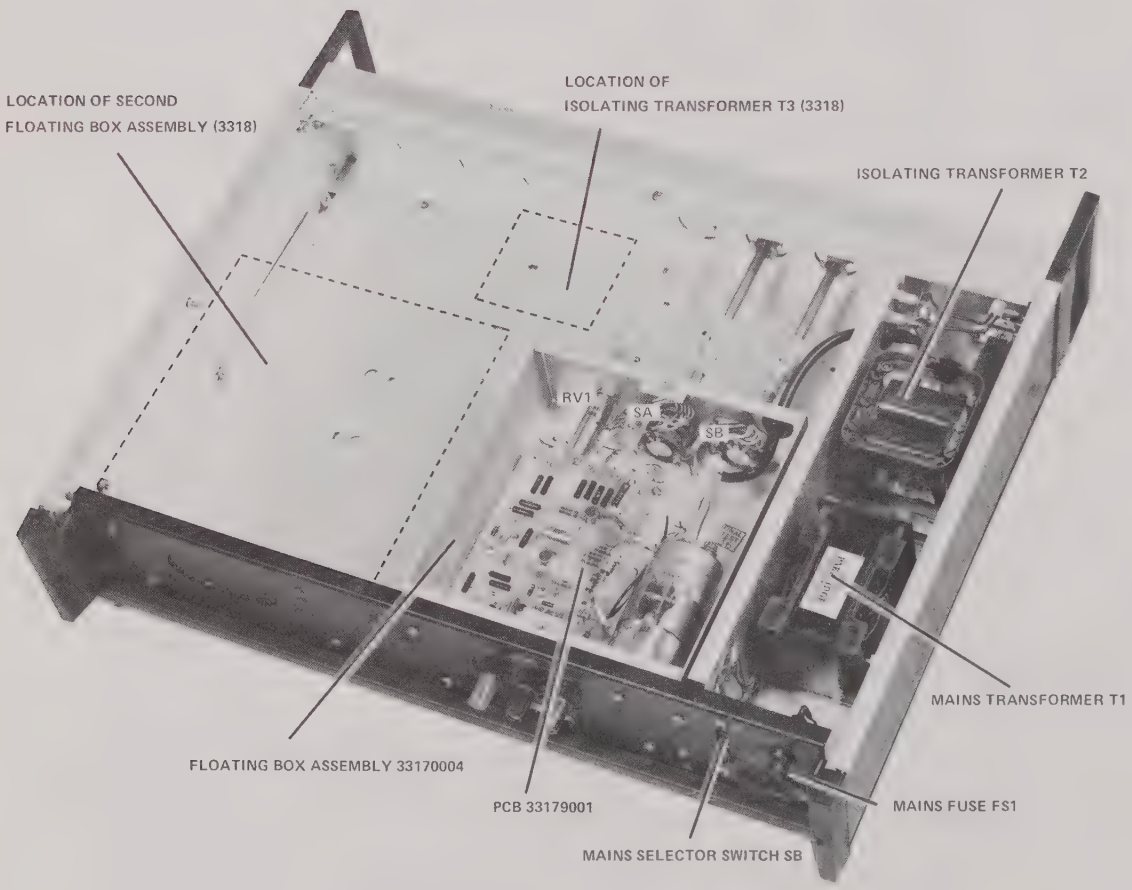


Fig. 4 Interior of 3317/3318 Power Supply

CALIBRATION PROCEDURE

1. Set mains selector switch SB on rear panel to 230V position. Fit 100mA SLO BLO mains fuse.

2. Apply mains to unit, 234V ± 10%.

3. Check that voltage between pin 16 (+) and pin 17 (–) on pcb 33179001 is approximately 45V.

4. Measure voltage at pin 15 on pcb 33179001 with respect to –40V rail. Adjust RV1 on pcb 33179001 and, if necessary, the links 1 through 4, to obtain 5.6V ± 0.1V.

5. Measure voltage at pin 12 on pcb 33179001 with respect to –40V rail. Adjust the '0.4 - 1.4' 'OUTPUT CURRENT' control RV1 from the front panel to obtain 5.6V ± 0.1V.

6. With no load applied, check that the voltage between terminals 'I+' and 'I–' is approximately 30V.

7. With a 100 ohms resistor connected between terminals 'I+' and 'I–' check that the output current flowing for each setting of the 'OUTPUT CURRENT' controls, SA and SB, is within 5% of nominal. Remove 100 ohms load.

8. Apply +100V across terminals 'I+' and 'I–' for at least 5 seconds.

9. Apply –100V across terminals 'I+' and 'I–' for at least 5 seconds.

10. Repeat 6. and 7.

11. Disconnect unit from mains supply.

12. Set mains selector switch on rear panel to 115V position. Fit 200mA SLO BLO mains fuse.

13. Apply mains to unit, 117V ± 10%.

14. Repeat 3. through 11.

15. Set mains selector to correspond with local mains supply voltage and fit appropriate mains fuse - 100mA for 230V mains or 200mA for 115V.

TEST EQUIPMENT REQUIRED

(i) 'Master Series' Digital Voltmeter A210 or equivalent.

(ii) 100Ω (± 1%) resistor.

Component Parts List

for

Printed Circuit Board 33179001

Cct Ref.	General Description				Solartron Part No.
R1	CACP	2.2k	1/4W	10%	172332200
R2	MEFM	820	1/4W	0.1%	198128201
R3	MEFM	820	1/4W	0.1%	198128201
R4	MEFM	470	1/4W	0.1%	198124701
R5	MEFM	390	1/4W	0.1%	198123901
R6	MEFM	750	1/4W	0.1%	198127501
R7	MEFM	1.5k	1/4W	0.1%	198131501
R8	MEFM	4.7k	1/4W	0.1%	198134704
R9	CACP	4.7k	1/4W	10%	172334700
R10	CACP	10k	1/8W	10%	172041000
R11	POWW	15k	3W	5%	173741500
R12	CACP	22k	1/8W	10%	172042200
R13	CACP	10k	1/4W	10%	172341000
R14	CACP	68k	1/4W	10%	172346800
R15	MEFM	300	1/4W	0.1%	198123004
R16	MEFM	560	1/4W	0.1%	198125604
R17	MEFM	470	1/4W	0.1%	198124704
R18	MEFM	1.2k	1/4W	0.1%	198131204
R19	MEFM	2.7k	1/4W	0.1%	198132704
R20	MEFM	5.6k	1/4W	0.1%	198135604
R21	MEFM	3.6k	1/4W	0.1%	198133604
R22	MEFM	220	1/4W	0.1%	198122204
R23	MEFM	220	1/4W	0.1%	198122204
R24	MEOX	3.9k	1W	5%	193433900
R25	MEOX	2.2k	1W	5%	193432200
R26	CACP	10k	1/4W	10%	172341000
R27	CACP	3.3k	1/4W	10%	172333300
R28	CACP	1k	1/4W	10%	172331000
R29	MEFM	270	1/4W	0.1%	198122701
R30	CACP	47k	1/4W	10%	172344700
R31	MEOX	4.3k	1/2W	5%	193534300
R32	MEOX	39k	1/2W	5%	193543900
R33	CACP	2.2M	1/8W	10%	172062200
RV1	CMPM	500	3/4W	20%	124025000
C1	CERM	0.01	500V	+80% —20%	241041000
C2	CERM	100p	500V	+10% —20%	241321000
C3	CERM	150p	500V	+10% -20%	241321500
C4	TAND	22	35V	20%	265972200
C5	CERM	0.047	25V	+50% —25%	241944700
C6	CERM	100p	500V	+10% —20%	241321000
C7	CERM	100p	500V	+10% -20%	241321000

Cct Ref.	General Description				Solartron Part No.
D1	BZY 88 C24 (24V)		400mW	5%	300523930
D2	BZY 88 C15 (15V)		400mW	5%	300521390
D3	IN4004	400 PIV			300522070
D4	IN821	(6.2V)	400mW	5%	300522460
D5	IN825	(6.2V)	400mW	5%	300523050
D6	BZY 88 C24 (24V)		400mW	5%	300523930
D7	IN3595				300523590
D8	IN4004	400 PIV			300522070
D9	IN3595				300523590
D10	Zener 30V		1.5W	5%	300521230
D11	IN4004				300522070
TR1	MM4001				300554050
TR2	BCY 70				300553590
TR3	BC107				300553320
TR4	U1899				300554320
TR5	Transistor 40327				300552890
TR6	Transistor 40327				300552890
TR7	Transistor BCY 70				300553590
TR8	Transistor BC107				300553320
TR9	Transistor BC107				300553320
IC1	operational amplifier LM308A				510090080
	Transistor Pad (For use with IC1)				300584520
	Transistor Pad (For use with TR1, 5, 6)				300584070
	Transistor Pad (For use with TR2, 3, 4, 7, 8, 9)				300584030

Component Parts List

for

Floating Box Assembly 33170004

Cct Ref.	General Description				Solartron Part No.
RV1	WWPM	20k	1.5W	5%	110150100
C1	ALME	2200	63V	+50% —10%	271592200
SA	Switch	rotary 10 way			379608601
SB	Switch	rotary 3 way			379608701

Component Parts List

for

Single Power Supply 3317
(Main Assembly)

Cct Ref.	General Description	Solartron Part No.
R1	CACP 22k 1/4W 10%	172342200
FS1	Fuse Slo-Blo 200mA (115V)	360106280
	Fuse Slo-Blo 100mA (230V)	360106260
	Fuse Holder	360206010
SA	Switch Push Button Mains	377000290
SB	Switch Slider 2 Pole	375000500
LP1	Lamp Neon Amber	300720411
T1	Transformer Mains	309606402
T2	Transformer Floating	309606102
PLA	Connector Mains	352303140
	Mains Lead	480140220
	Insulated terminal red	355100510
	Insulated terminal black	355100500
	Insulated terminal green	355100550

Component Parts List

for

Twin Power Supply 3318
(Main Assembly)

Cct Ref.	General Description	Solartron Part No.
R1	CACP 22k 1/4W 10%	172342200
T1	Transformer Mains	309606402
T2 and T3	Transformer Floating	309606102
SA	Switch Push Button Mains	377000290
SB	Switch Slider 2 pole	375000500
LP1	Neon Amber	300720411
FS1	Fuse Slo-Blo 160mA (230V)	360106270
FS1	Fuse Slo-Blo 250mA (115V)	360106290
	Fuse Holder	360206010
PLA	Connec⁺or Mains	352303140
	Cable Mains	480140220
	Insulated Terminal Red	355100510
	Insulated Terminal Black	355100500
	Insulated Terminal Green	355100550

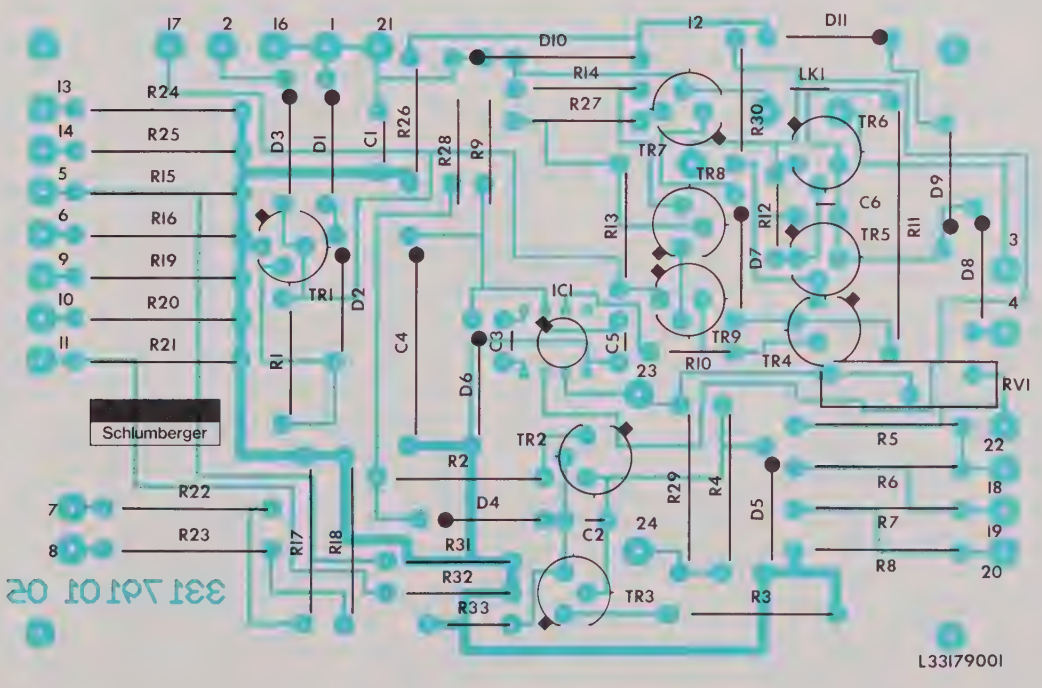
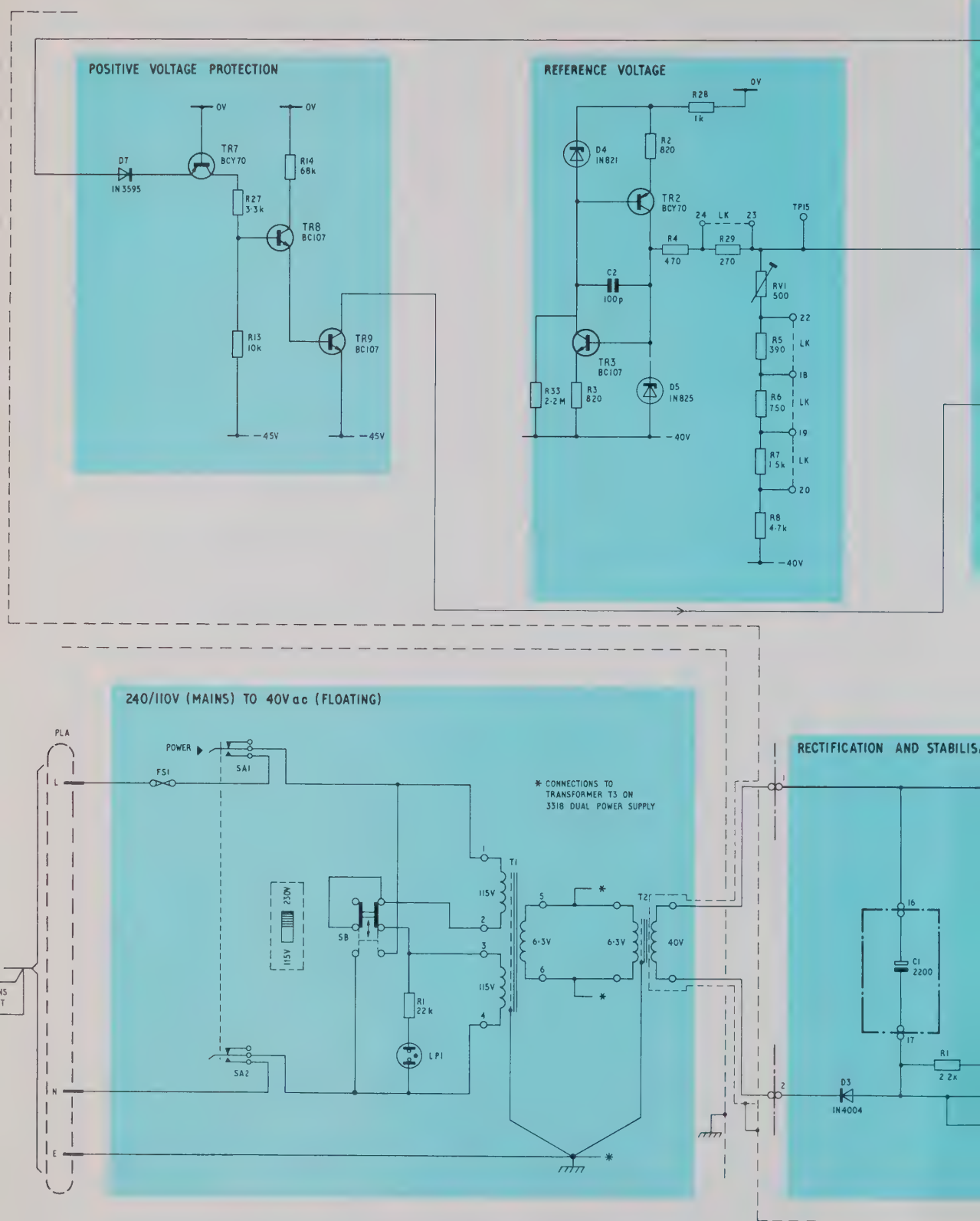
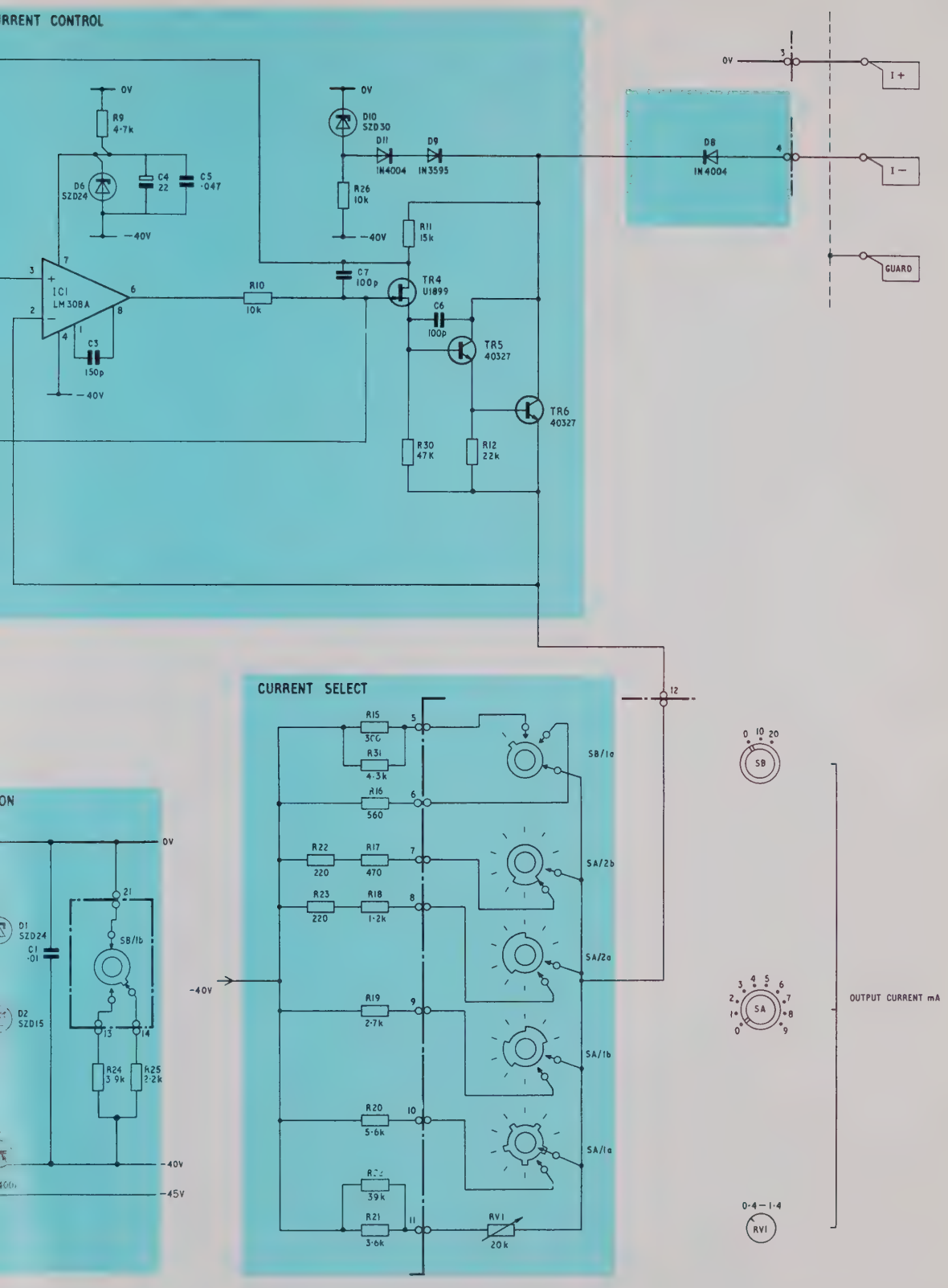


Fig. 5 Component Location; pcb 33179001


POSITIVE VOLTAGE PROTECTION
0V
0V
D7
IN 3595
TR7
BCY70
R14
68k
R27
3·3k
TR8
BC107
R13
10k
TR9
BC107
-45V
-45V
REFERENCE VOLTAGE
0V
R28
1k
D4
IN821
R2
820
TR2
BCY70
24
LK
23
TP15
R4
470
R29
270
C2
100p
RV1
500
22
R5
390
LK
18
R6
750
LK
19
R7
1·5k
LK
20
R8
4·7k
-40V
TR3
BC107
R33
2·2M
R3
820
D5
IN825
-40V
240/110V (MAINS) TO 40V ac (FLOATING)
PLA
POWER
SA1
FS1
L
N
E
* CONNECTIONS TO
TRANSFORMER T3 ON
3318 DUAL POWER SUPPLY
T1
115V
115V
115V
230V
115V
SB
R1
22k
LP1
SA2
T2
6·3V
6·3V
40V
RECTIFICATION AND STABILIS
1
2
16
17
C1
2200
R1
2·2K
D3
IN4004



NOTE :- IN THE 3318 DUAL POWER SUPPLY
THE CIRCUITRY FROM TRANSFORMER T2 (T3)
INCLUSIVE IS REPEATED.

Circuit Diagram 1 : 3317/3318 Power Supply

SECTION 5/6 Thermocouple Cold Junction Compensation Unit 3310

INTRODUCTION

The emf produced by a thermocouple (Fig. 1) is related to the difference in temperature between the 'hot' junction and the 'cold' junction. In practice, the hot junction is a temperature transducer and the cold junction the transducer connections to the measuring system, i.e., the scanner input terminals.

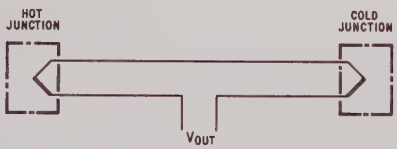


Fig. 1 Basic Thermocouple Circuit

To obtain a meaningful temperature reading, it is necessary to relate the cold junction temperature to a known reference temperature. This can be achieved in one of two ways:

a) the cold junction can be maintained at the reference temperature, or

b) any difference between the cold junction temperature and the reference temperature can be compensated for.

The second method is generally found to be the most convenient. A standard reference temperature of $0^{o}C$ is used, thus enabling a zero voltage transducer output to be obtained for zero temperature measurement.

Temperature compensation is carried out by a network of temperature sensitive resistors. When energised by a primary cell, the network produces an emf which corresponds to the difference between the temperature of the cold junction and $0^{o}C$. Both the cold junction and the compensating network are located in an isothermal compartment, the output of the compensating network being connected in series with the measuring circuit, as shown in Fig. 2. Thus, the effect of the cold junction is offset, and the resulting emf to be measured corresponds directly to the temperature of the hot junction.

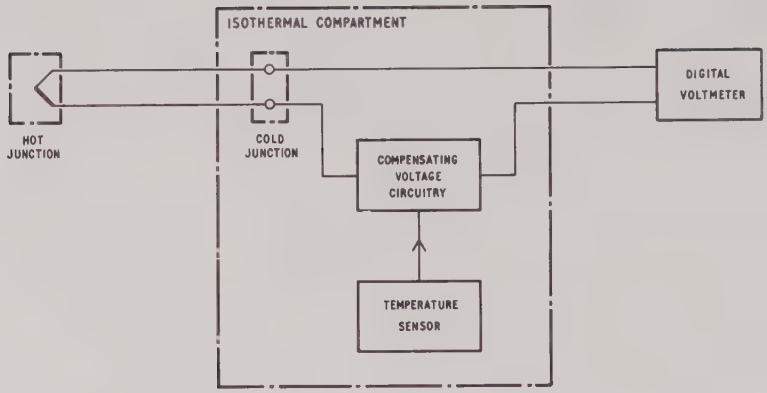


Fig. 2 Cold Junction Compensation : Simplified Block Diagram

The cold junction compensation unit 3310 (Fig. 3) provides these facilities and is fitted to the rear of the scanner when thermocouples are used.

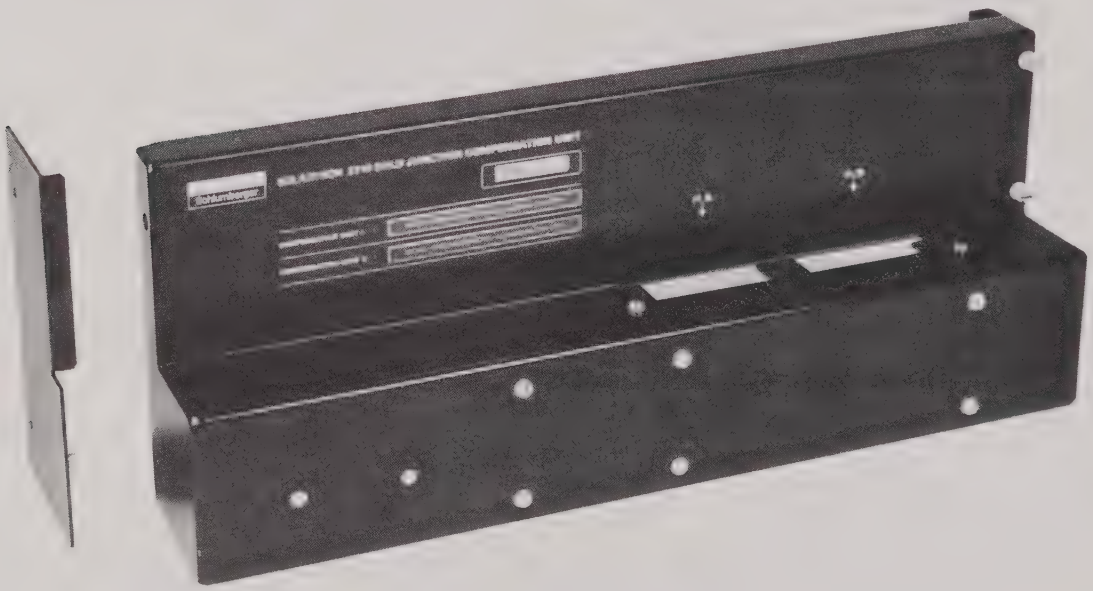


Fig. 3 Cold Junction Compensation Unit 3310

GENERAL DESCRIPTION

The unit fits onto the rear of the scanner by means of a side plate, containing two locating spigots, and two screws. At one end of the unit is mounted a socket which automatically makes the necessary internal control and analogue connections when the unit is fitted to the scanner.

At the bottom edge of the unit is a strip of thermal insulating material which allows entry for the thermocouple leads whilst retaining the isothermal conditions. Thermocouple lead connections are made at the selector module input connectors (3306) in the normal way, and these form the cold junctions. The analogue output connections are made at the sockets marked PLD and PLE on the face of the unit. These sockets replace the scanner analogue sockets which are now covered by the unit.

The unit contains two printed circuit boards and a 1.35V mercury cell. On one of these boards is soldered one or two thermocouple reference units (sense modules). Each reference unit is associated with a separate compensating circuit, thus enabling the 3310 to be used with two different types of thermocouple. The reference units determine the cold junction compensation and are selected from a range to suit the particular thermocouples in use.

Thermocouple cold junction compensation is applied to particular channels as required by programming within the scanner.

RANGE OF REFERENCE UNITS

Reference units are available for six different types of thermocouple, to three different standards, as listed in Table 1. It should be noted that the range may be amended from time to time.

Table 1

Range of Reference Units

Standard	Thermocouple
B.S. (British), DIN (German) or I.S.A. (American)	Copper/Constantan
	Nickel, Chrome/Constantan
	Nickel, Chrome/Nickel, Aluminium
	Platinum/Platinum, 10% Rhodium
	Platinum/Platinum, 13% Rhodium
	Iron/Constantan

The appropriate reference units, to suit the customer's requirements at the time of ordering, are fitted during manufacture. The type of reference unit(s) fitted to the 3310 is clearly labelled on the face panel.

FITTING A REFERENCE UNIT

If it is required to fit a reference unit proceed as follows:-

(1) Remove the 3310 from the scanner.

(2) Remove the reference unit shield plate retaining screws (four) and lift off the plate (Fig. 4).

(3) Remove the '+ O/P -' shorting link (if present) from the position at which the reference unit is to be fitted.

Note: If only one reference unit is required it should be fitted in position 1.

(4) Solder the four connections of the reference unit to the corresponding pins on the printed circuit board, using a heat shunt. The connections are clearly marked on both the reference unit and the board.

(5) Refit the shield plate and secure with the four screws.

(6) Refit the 3310 to the scanner.

(7) Attach the appropriate descriptive label (s) to the face panel for the unit (s) used.

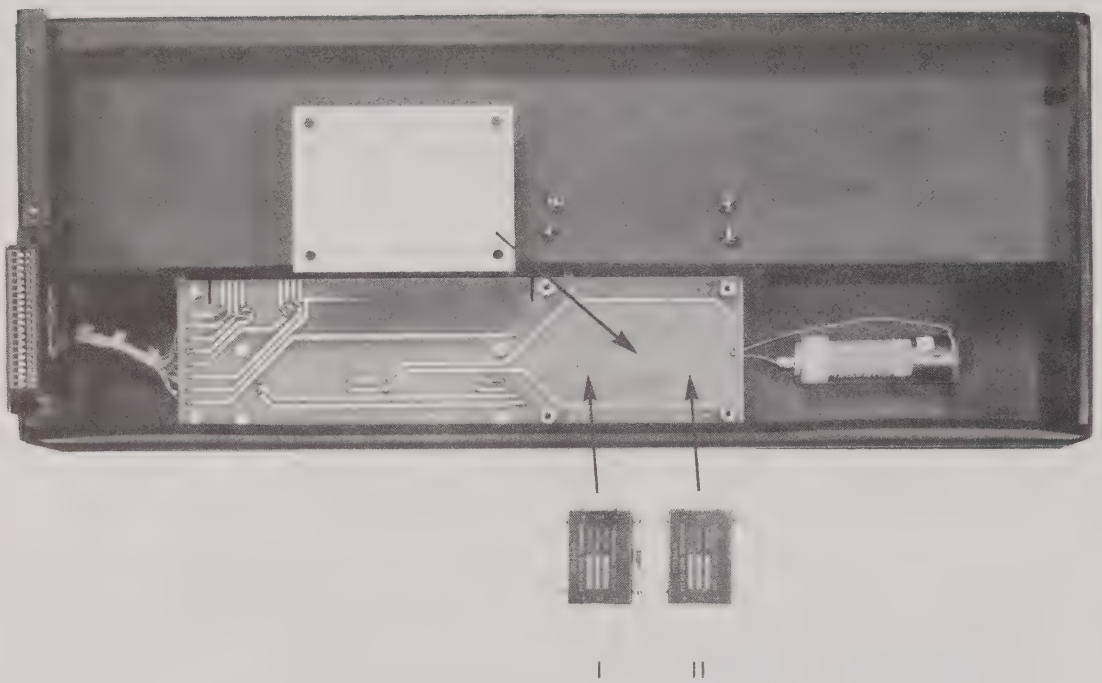


Fig. 4 Location of Reference Units

PROGRAMMING

The following facilities can be programmed:

(1) Direct e.m.f. measurement (no compensation).

(2) Cold junction compensation with reference unit No. 1.

(3) Cold junction compensation with reference unit No. 2.

Programs can be applied to blocks of ten channels (each selector module) or, where a 3309 program selector module is used, to individual channels. For programming details refer to Sections 5/1 and 5/3.

COMPONENT PARTS LIST

ABBREVIATIONS

Circuit References

B	Battery
C	Capacitor (μF)
CSR	Thyristor
D	Diode
FS	Fuse
IC	Integrated Circuit
L	Inductor
LP	Lamp (including Neon)
LK	Link
M	Meter
MSP	Mains Selector Panel
PL	Plug
R	Resistor (Ω)
RL	Relay
S	Switch
SK	Socket
T	Transformer
TP	Terminal Post (or Test Point)
TR	Transistor
V	Valve
X	Other Components

Also Used:-

RNL	Non Linear Resistor (Ω)
RV	Variable Resistor (Ω)

Component Composition

FIXED RESISTORS

Carbon Composition	CACP
Carbon Film	CAFM
Cracked Carbon	CKCA
Metal Film	MEFM
Metal Oxide	MEOX
Power Wirewound	POWW
Precision Wirewound	PRWW
Temperature Sensitive	TEMP
Thick Film	TKFM
Thin Film	TNFM
Voltage Sensitive	VOLT

Component Composition (Cont'd)

VARIABLE RESISTORS

Wirewound Preset Single Turn	WWPS
Wirewound Preset Multiturn	WWPM
Wirewound Front Panel Single Turn	WWFS
Wirewound Front Panel Multiturn	WWFM
Carbon Preset Single Turn	CAPS
Carbon Preset Multiturn	CAPM
Carbon Front Panel Single Turn	CAFS
Carbon Front Panel Multiturn	CAFM
Cermet Preset Single Turn	CMPS
Cermet Preset Multiturn	CMPM
Cermet Front Panel Single Turn	CMFS
Cermet Front Panel Multiturn	CMFM

CAPACITORS

Air	AIR
Aluminium Electrolytic	ALME
Aluminium Solid	ALMS
Polycarbonate	CARB
Ceramic	CERM
Polyester Foil	ESTF
Polyester Metallised	ESTM
Glass	GLAS
Mica	MICA
Metallised Lacquer	MLAC
Paper Foil	PAPF
Paper Metallised	PAPM
PTFE	PTFE
Polypropylene Film	PYLN
Polystyrene	STYR
Tantalum Dry	TAND
Tantalum Foil	TANF
Tantalum Wet	TANW

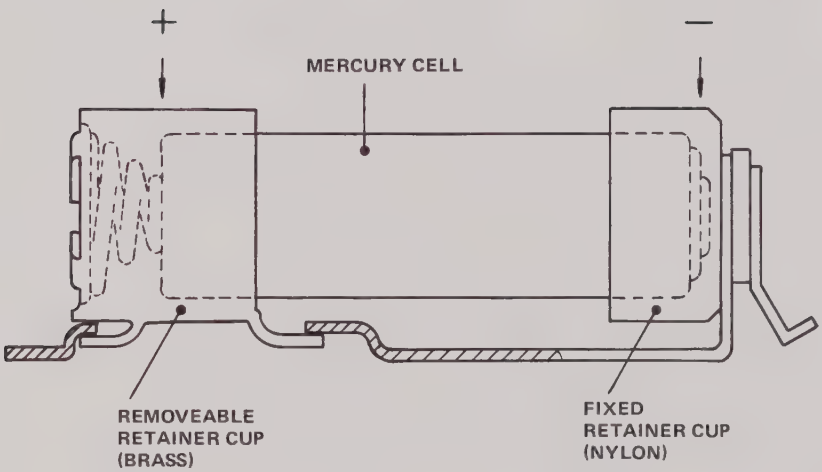


Fig. 5 Mercury cell in holder

CIRCUIT DESCRIPTION

The compensating network of the 3310 Cold Junction Compensator is contained on two pcb's. Cold junction compensation is effected by means of Sense Module 1 or Sense Module 2 on board 1, while selection of one sense module or the other is carried out by the compensation command logic on board 2.

On board 1, a sense module is energised by connecting a 1.35V mercury cell to the supply terminals through a pair of reed relay contacts; the module is then able to insert a cold junction compensating voltage into line 1 of Analogue Bus 'A'. The remainder of the analogue busses are routed straight through the board.

The compensation command logic on board 2 allows one sense module only to be called at a time, this constraint being effected by the configuration of quadruple NAND gate IC1. Hence the action of the compensation commands C1 and C2 is as shown in table 2.

Table 2

Comp. Comd		Transistor States				Sense Module Energised
C1	C2	Q1	Q2	Q3	Q4	
Hi	Hi	OFF	OFF	OFF	OFF	–
Lo	Hi	ON	OFF	ON	OFF	Sense Module 1
Hi	Lo	OFF	ON	OFF	ON	Sense Module 2
Lo	Lo	ON	ON	OFF	OFF	–

MERCURY CELL REPLACEMENT

The mercury cell (Mallory Duracell RM – 12R) that is used to energise the compensating network has a working life of 1000 hours. The cell should be replaced after 1000 hours of use or, in any case, after one year. Note that the cell is brought into operation only when thermocouples are actually being monitored, and so the life of 1000 hours corresponds typically to one million thermocouple measurements recorded on a slow output device or to some ninety million measurements while fast alarm scanning. When the cell needs to be replaced, proceed as follows:-

(a) Remove the 3310 Cold Junction Compensator from the rear of the scanner by unscrewing the two knurled retaining screws at the right hand end (viewed from the rear) and easing the unit clear from the retaining spigots at the left hand end.

(b) Lay the unit on its back, as shown in Fig. 4, thus exposing the mercury cell in its holder.

(c) Remove the spent mercury cell from the holder, shown in Fig. 5, by pushing the brass retainer cup in towards the nylon retainer cup and then lifting the brass retainer cup away, outer end first, together with the cell.

(d) Insert the new cell with the negative end towards the nylon retainer cup, pushing the brass retainer cup over the positive end of the cell, towards the negative end and downwards, so that both flanges on the brass retaining cup enter the slot in the holder base plate. Allow the spring within the brass retaining cup to expand, thus moving the cup to the 'secured' position shown in Fig. 5.

(e) Fit the 3310 Cold Junction Compensator onto the rear of the scanner, engaging the retaining spigots first and ensuring that socket SKA on the cold junction compensator engages correctly with plug PLE on the scanner. Secure the knurled retaining screws.

Component Parts List

for

Printed Circuit Board 840-11-01

(3310 Cold Junction Compensator)

Cct Ref.	General Description				Solartron Part No.
R1	MEOX	6.8k	½W	5%	193536800
R2	MEOX	6.8k	½W	5%	193536800
R3	MEOX	10k	½W	5%	193541000
R4	MEOX	220	½W	5%	193522200
R5	MEOX	10k	½W	5%	193541000
R6	MEOX	220	½W	5%	193522200
R7 to R9	MEOX	1k	½W	5%	193531000
R10	MEOX	10k	½W	5%	193541000
R11	MEOX	270	½W	5%	193522700
R12	MEOX	10k	½W	5%	193541000
R13	MEOX	270	½W	5%	193522700
Q1	Transistor BCY70				300553590
Q2	Transistor BCY70				300553590
Q3	Transistor MM1614				300551670
Q4	Transistor MM1614				300551670
	Transistor Pad (For use with Q1, Q2)				300584030
	Transistor Pad (For use with Q3, Q4)				300584090
IC1	SN7400N				510000340
Coil A	Relay Drive Coil				309501101
Coil B	Relay Drive Coil				309501101

Component Parts List

for

Printed Circuit Board 840-11-02

(3310 Cold Junction Compensator)

Cct Ref.	General Description	Solartron Part No.
RLA	Reed Relay Insert	379602701
RLB	Reed Relay Insert	379602701
	Sensing Module	33100102

Component Parts List

for

Main Chassis Assembly

3310 Cold Junction Compensator

Cct Ref.	General Description	Solartron Part No.
SKA	Connector 20 Way	352520020
	Mercury Cell 1.35V (Mallory Duracell RM-12R)	

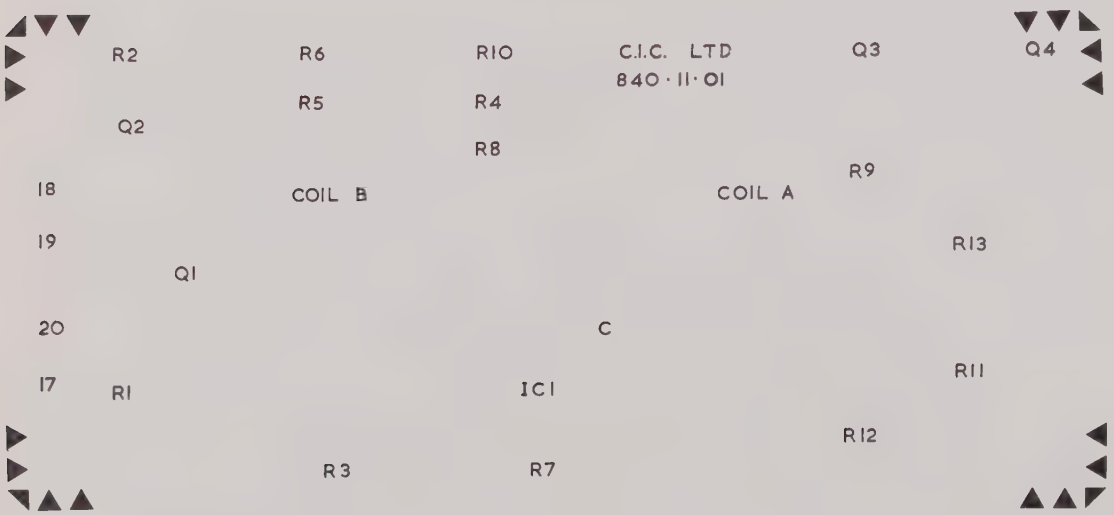
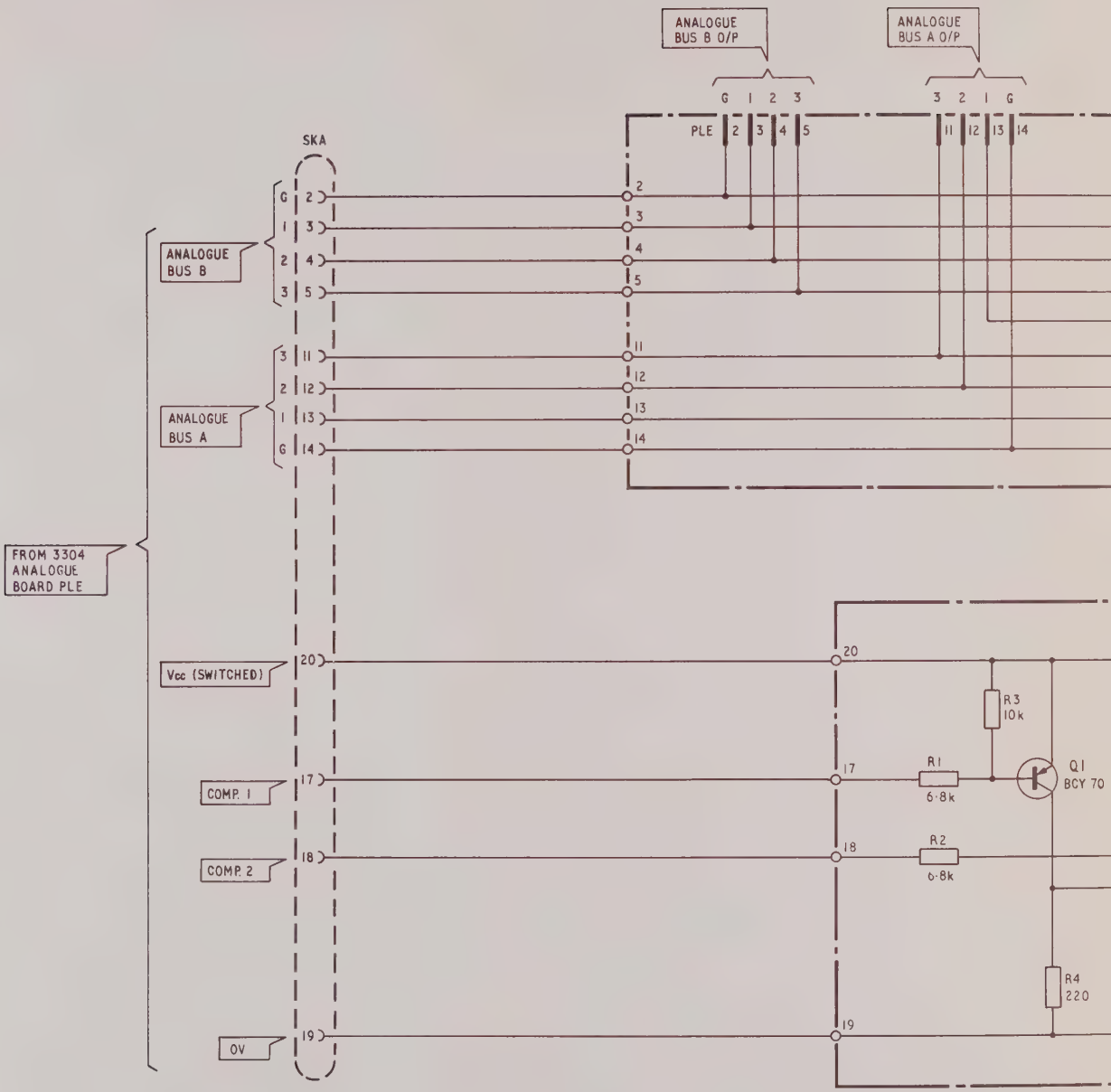
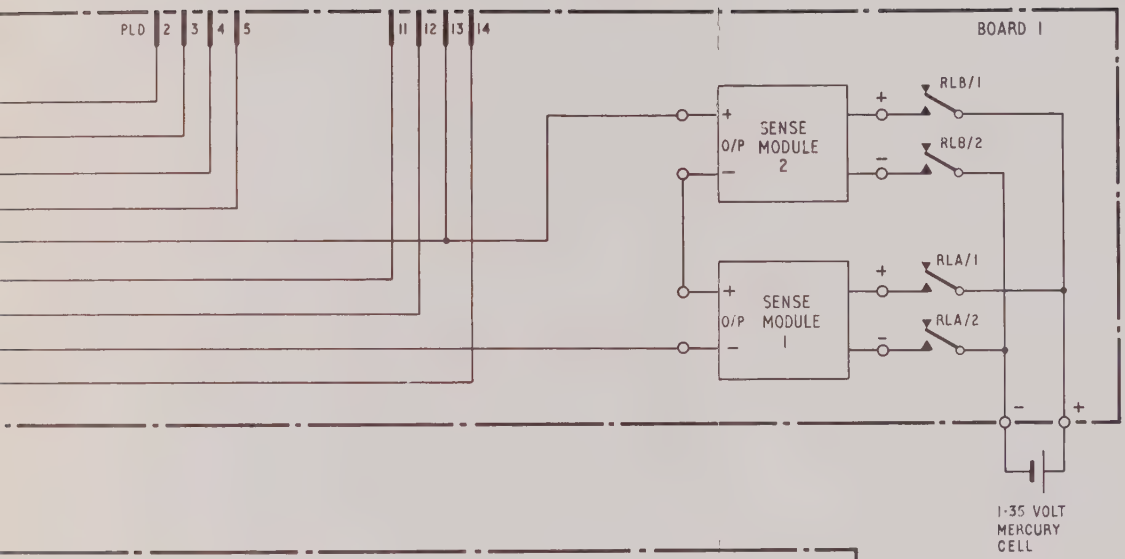
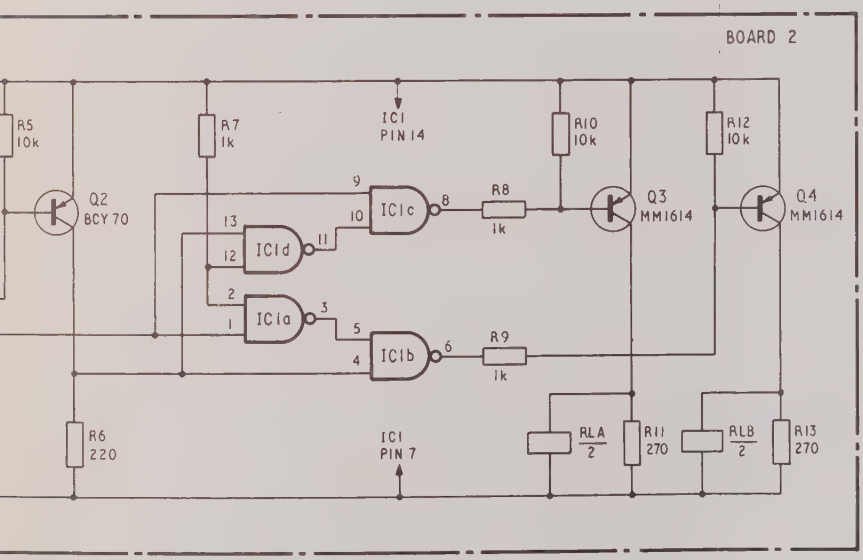


Fig. 6 Component Location; pcb 840.11.01


ANALOGUE BUS B O/P
ANALOGUE BUS A O/P
G 1 2 3
3 2 1 G
PLE 2 3 4 5
11 12 13 14
SKA
G 2
1 3
2 4
3 5
ANALOGUE BUS B
3 11
2 12
1 13
G 14
ANALOGUE BUS A
FROM 3304 ANALOGUE BOARD PLE
Vcc (SWITCHED) 20
COMP. 1 17
COMP. 2 18
0V 19
2
3
4
5
11
12
13
14
20
17
18
19
R3 10k
R1 6·8k
R2 6·8k
R4 220
Q1 BCY 70





Circuit Diagram 1 : 3310 Cold Junction Compensator

SECTION 5/7

Power Supply Unit 3377

INTRODUCTION

The 3377 Resistance Thermometer Power Supply provides an energising supply for platinum resistance thermometers, set to either 100μA or 250μA by a rear panel switch.

Power for the unit is obtained from a 115V/230V mains supply. Mains voltage selection is by means of a selector switch on the rear panel and the mains fuse rating, for each setting, is:-

(a) 115V; 200mA (SLO BLO)

(b) 230V; 100mA (SLO BLO)

CAUTION: Before switching the unit on, check that the mains selector setting corresponds with the mains voltage and that the correct mains fuse is fitted.

The POWER switch, with which the mains input to the unit is controlled, is a red push-button switch located on the front panel. Above this is an amber lamp that is illuminated when the mains is 'on'.

OUTPUT CONNECTIONS

The three output terminals provided are suitable for 4mm plugs or 'spade' type connectors, and are colour coded as follows:

RED - Output Current +

BLACK - Output Current –

GREEN - Guard Terminal

OUTPUT CONTROLS

In addition to the '100μA/250μA' output current selector switch, a 'SET 250μA' control is provided for adjusting the 250μA output current. A pre-set potentiometer, accessible through a hole in the rear panel, allows adjustment of the internal reference voltage. Both this and the 'SET 250μA' control should only be used for calibration purposes.

COMPONENT PARTS LIST

ABBREVIATIONS

Circuit References

B	Battery
C	Capacitor (μF)
CSR	Thyristor
D	Diode
FS	Fuse
IC	Integrated Circuit
L	Inductor
LP	Lamp (including Neon)
LK	Link
M	Meter
MSP	Mains Selector Panel
PL	Plug
R	Resistor (Ω)
RL	Relay
S	Switch
SK	Socket
T	Transformer
TP	Terminal Post (or Test Point)
TR	Transistor
V	Valve
X	Other Components

Also Used:-

RNL	Non Linear Resistor (Ω)
RV	Variable Resistor (Ω)

Component Composition

FIXED RESISTORS

Carbon Composition	CACP
Carbon Film	CAFM
Cracked Carbon	CKCA
Metal Film	MEFM
Metal Oxide	MEOX
Power Wirewound	POWW
Precision Wirewound	PRWW
Temperature Sensitive	TEMP
Thick Film	TKFM
Thin Film	TNFM
Voltage Sensitive	VOLT

Component Composition (Cont'd)

VARIABLE RESISTORS

Wirewound Preset Single Turn	WWPS
Wirewound Preset Multiturn	WWPM
Wirewound Front Panel Single Turn	WWFS
Wirewound Front Panel Multiturn	WWFM
Carbon Preset Single Turn	CAPS
Carbon Preset Multiturn	CAPM
Carbon Front Panel Single Turn	CAFS
Carbon Front Panel Multiturn	CAFM
Cermet Preset Single Turn	CMPS
Cermet Preset Multiturn	CMPM
Cermet Front Panel Single Turn	CMFS
Cermet Front Panel Multiturn	CMFM

CAPACITORS

Air	AIR
Aluminium Electrolytic	ALME
Aluminium Solid	ALMS
Polycarbonate	CARB
Ceramic	CERM
Polyester Foil	ESTF
Polyester Metallised	ESTM
Glass	GLAS
Mica	MICA
Metallised Lacquer	MLAC
Paper Foil	PAPF
Paper Metallised	PAPM
PTFE	PTFE
Polypropylene Film	PYLN
Polystyrene	STYR
Tantalum Dry	TAND
Tantalum Foil	TANF
Tantalum Wet	TANW

CIRCUIT DESCRIPTION

240V/110V Mains to 40V ac (floating)

The mains selector switch SB allows input power to be obtained from either 240V or 110V mains sources. In the '230V' position of switch SB the two primary windings of mains transformer T1 are connected in series to the mains source, while in the '115V' position they are connected in parallel. Mains isolation is obtained by the use of transformer T2.

Rectification and Stabilisation

The 40V ac output of transformer T2 is rectified by diode D3 and smoothed by capacitor C1, and is then stabilised by means of series regulator TR1, whose emitter is held at approximately −40V by zener diodes D1 and D2. To ensure the stable operation of TR1 a current drain of approximately 18mA is taken from its emitter through resistor R25.

Output Current Control

The output current of the power supply is set by means of the CURRENT SELECT controls: switch SA provides for the selection of either a 100μA or a 250μA output current, while variable resistor RV1 provides for fine adjustment of the 250μA output current.

The voltage that is developed across the CURRENT SELECT network is the product of the network resistance and the output current. This voltage is compared with a REFERENCE VOLTAGE of approximately 5.6V by comparator IC1 in the CURRENT CONTROL network. The output of comparator IC1 adjusts series regulator TR4, such that the CURRENT SELECT voltage equals the REFERENCE VOLTAGE, hence the output current is constant and equals,

$$\frac{\text{REFERENCE VOLTAGE}}{\text{CURRENT SELECT RESISTANCE}}$$

Voltage Protection

To prevent damage being caused by externally applied voltages, the power supply employs both negative and positive voltage protection.

Negative voltage protection is carried out by diode D8, which becomes reversed biased when the externally applied voltage at the I− terminal is more negative than that produced by the power supply at D8 emitter.

The POSITIVE VOLTAGE PROTECTION network becomes effective when an externally applied voltage causes the I− terminal of the power supply to become positive with respect to the I+ terminal. Transistors TR7, TR8 and TR9 are then switched on, thus switching off series regulator TR4 in the CURRENT CONTROL network.

ACCESS TO UNIT INTERIOR

Access to the interior of the 3377 Resistance Thermometer Power Supply is obtained as follows:-

(i) unscrew side panel retaining screws at rear of unit and slide off side panels towards rear.

(ii) slide off top panel towards rear of unit.

(iii) to obtain access to the interior of the floating box assembly, unscrew the two screws securing the cover plate and remove the plate from the assembly.

CALIBRATION PROCEDURE

1. Set mains selector switch SB on rear panel to 230V position. Fit 100mA SLO BLO mains fuse.

2. Apply mains to unit, 234V ± 10%.

3. Check that voltage between pin 16 (+) and pin 17 (–) on pcb 33779001 is approximately 45V.

4.a) Connect a 100 ohms resistor between terminals 'I+' and 'I–'.

b) Set the 'CURRENT SELECT' switch SA, accessible from rear panel, to the '100μA' position.

c) Adjust RV1 on pcb 33779001 and, if necessary, the links 1 through 4, to obtain an output current of 100μA ± 10nA.

5.a) Set the 'CURRENT SELECT' switch to the '250μA' position.

b) Adjust the 'SET 250μA' control (rear panel) to obtain an output current of 250μA ± 25nA.

c) Remove the 100 ohms load.

6. Apply +100V across terminals 'I+' and 'I–' for at least 5 seconds.

7. Apply –100V across terminals 'I+' and 'I–' for at least 5 seconds.

8. Repeat 4. and 5.

9. Disconnect unit from mains supply.

10. Set mains selector switch on rear panel to 115V position. Fit 200mA SLO BLO mains fuse.

11. Apply mains to unit, 117V ± 10%.

12. Repeat 3. through 9.

13. Set mains selector to correspond with local mains supply voltage and fit appropriate mains fuse - 100mA for 230V mains or 200mA for 115V mains.

TEST EQUIPMENT REQUIRED

(i) 'Master Series' Digital Voltmeter A210 or equivalent.

(ii) Precision resistor, 100Ω ± 0.005%.

Component Parts List

for

Printed Circuit Board 33779001

Cct Ref.	General Description				Solartron Part No.
R1	CACP	2.2k	1/4W	10%	172332200
R2	MEFM	820	1/4W	0.1%	198128201
R3	MEFM	820	1/4W	0.1%	198128201
R4	MEFM	470	1/4W	0.1%	198124701
R5	MEFM	390	1/4W	0.1%	198123901
R6	MEFM	750	1/4W	0.1%	198127501
R7	MEFM	1.5k	1/4W	0.1%	198131501
R8	MEFM	4.7k	1/4W	0.1%	198134704
R9	CACP	4.7k	1/4W	10%	172334700
R10	CACP	10k	1/8W	10%	172041000
R11	POWW	15k	3W	5%	173741500
R13	CACP	10k	1/4W	10%	172341000
R14	CACP	68k	1/4W	10%	172346800
R18	MEFM	56k	1/4W	0.1%	198145604
R19	MEFM	56k	1/4W	0.1%	198145604
R21	MEFM	100k	1/4W	0.1%	198151004
R23	MEFM	820	1/4W	0.1%	198328204
R24	MEOX	3.9k	1W	5%	193433900
R25	MEOX	2.2k	1W	5%	193432200
R26	CACP	10k	1/4W	10%	172341000
R27	CACP	3.3k	1/4W	10%	172333300
R28	CACP	1k	1/4W	10%	172331000
R29	MEFM	270	1/4W	0.1%	198122701
R30	CACP	22k	1/4W	10%	172342200
C1	CERM	0.01	500V	+80% -20%	241041000
C2	CERM	100p	500V	+10% -20%	241321000
C3	CERM	150p	500V	+10% -20%	241321500
C4	TAND	22	35V	20%	265972200
C5	CERM	0.047	25V	+50% -25%	241944700
C7	CERM	100p	500V	+10% -20%	241321000
R31	MEOX	4.3k	1/2W	5%	193534300
R32	MEOX	39k	1/2W	5%	193543900
R33	CACP	2.2M	1/8W	10%	172062200
D1	BZY88 C24 (24V)		400mW	5%	300523930
D2	BZY88 C15 (15V)		400mW	5%	300521390
D3	IN4004				300522070
D4	IN821		400mW	5%	300522460
D5	IN825		400mW	5%	300523050
D6	BZY88 C24 (24V)		400mW	5%	300523930
D7	IN3595				300523590
D8	IN4004				300522070
D9	IN3595				300523590
D10	SZD30 (30V)		1.5W	5%	300521230
D11	IN4004				300522070
TR1	MM4001				300554050
TR2	BCY70				300553590
TR3	BC107				300553320
TR4	U1899				300554320
TR7	BCY70				300553590
TR8	BC107				300553320
TR9	BC107				300553320
RV1	CMPM	500	3/4W	20%	124025000
IC1	LM308A				510090080
	Transistor PAD (for use with TR2,3,4, 7,8,9)				300584030
	Transistor PAD (for use with TR1)				300584070
	Transistor PAD (for use with IC1)				300584520

Component Parts List

for

Plat. Res. Therm. Power Supply 3377

(Main Assembly)

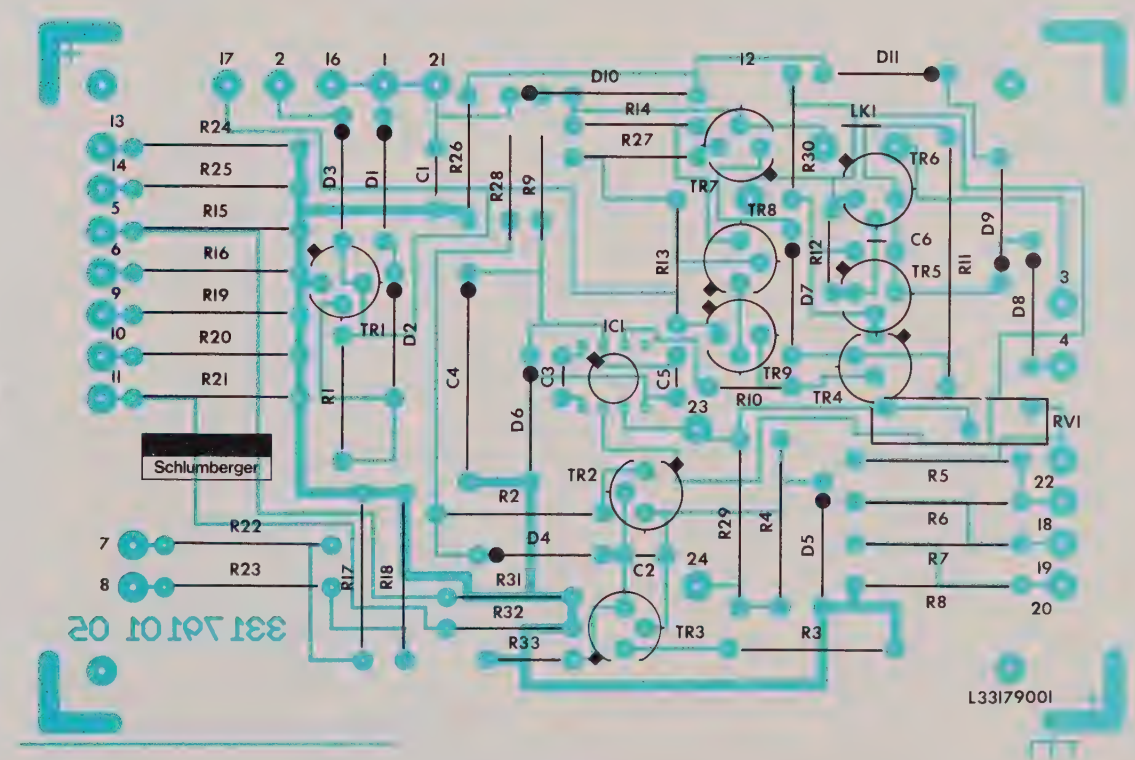
Cct Ref.	General Description	Solartron Part No.
FS1	Fuse 100mA Slo-Blo (230V mains) Fuse 200mA Slo-Blo (115V mains) Fuse Holder	360106260 360106280 360206010
SA SB	Switch Slider 2 Pole Switch Push-Button Mains	375000500 377000290
LP1	Lamp Neon Amber	300720411
R1	CACP 22k 1/4W 10%	172342200
T1 T2	Transformer Mains Transformer Isolating	309606402 309606102
PLA	Mains Plug	352303140
	Mains Lead	480140220

Component Parts List

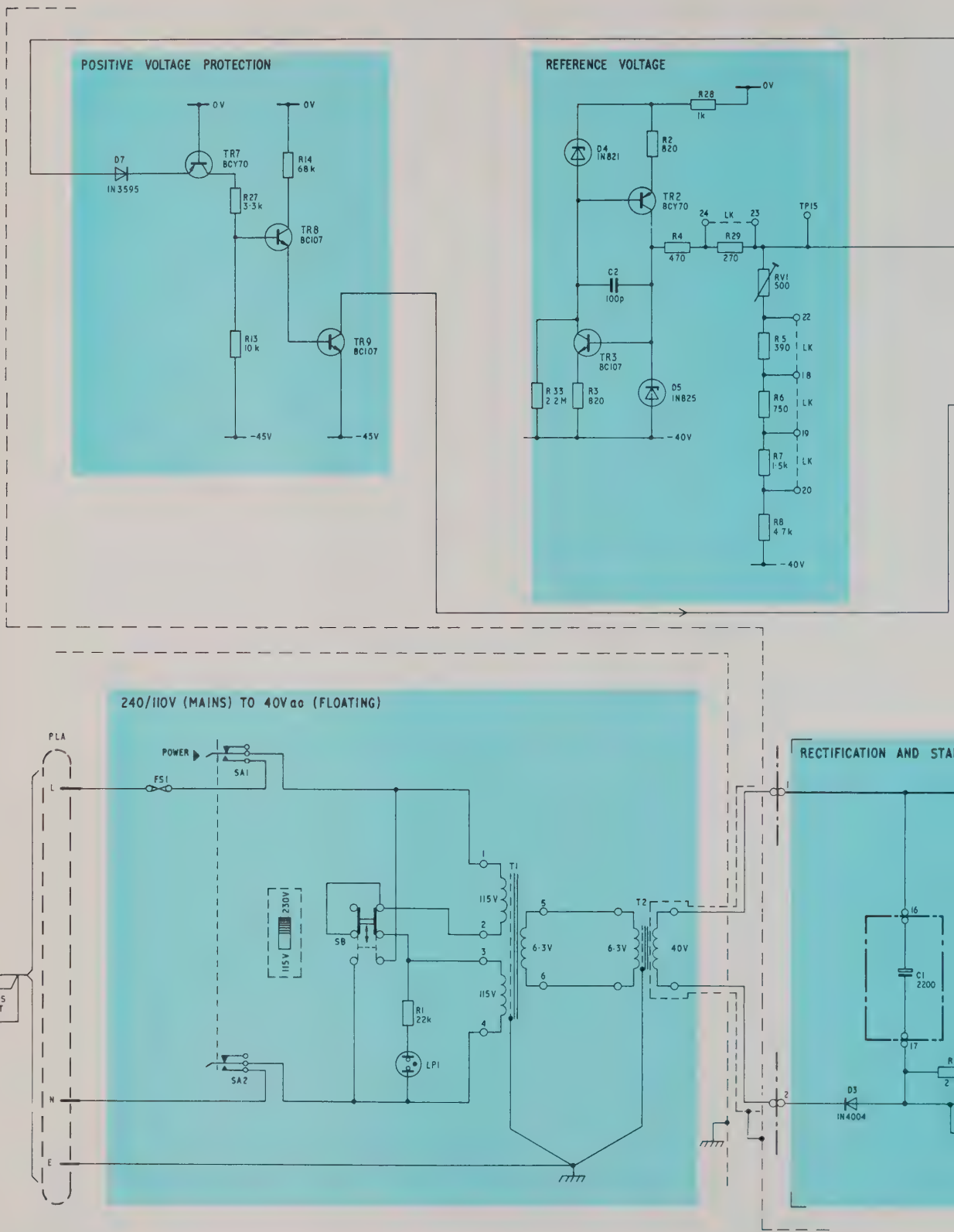
for

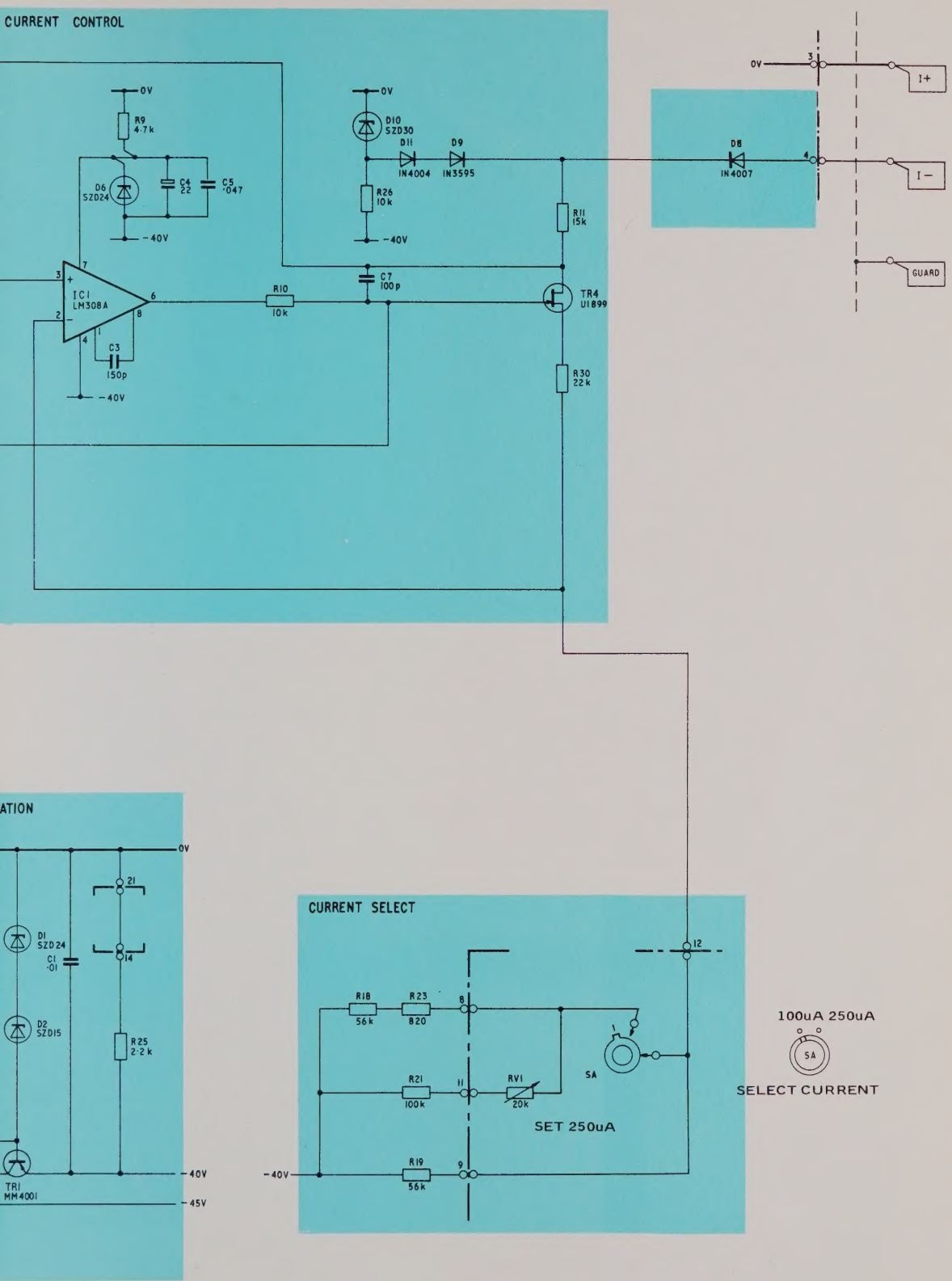
Floating Box Assembly 33770004

Cct Ref.	General Description				Solartron Part No.
C1	ALME	2200	63V	+50% —10%	271592200
SA	Switch Rotary 2 Way				379612201
RV1	WW	20k	1.5W	5%	110150100



Component Location; pcb 33779001


POSITIVE VOLTAGE PROTECTION
0V
0V
D7
IN3595
TR7
BCY70
R14
68k
R27
3·3k
TR8
BC107
R13
10k
TR9
BC107
-45V
-45V
REFERENCE VOLTAGE
0V
R28
1k
D4
IN821
R2
820
TR2
BCY70
24
LK
23
TP15
R4
470
R29
270
C2
100p
RV1
500
22
R5
390
LK
18
R6
750
LK
19
R7
1·5k
LK
20
R8
4·7k
-40V
TR3
BC107
R33
2·2M
R3
820
D5
IN825
-40V
240/110V (MAINS) TO 40V ac (FLOATING)
PLA
POWER
SA1
FS1
L
N
E
MAINS INPUT
SA2
SB
115V
230V
T1
1
115V
2
3
115V
4
5
6·3V
6
6·3V
T2
40V
R1
22k
LP1
RECTIFICATION AND STA
16
C1
2200
17
D3
IN4004
2



Circuit Diagram 1 : 3377 Power Supply

www.manualsplus.com
1003511